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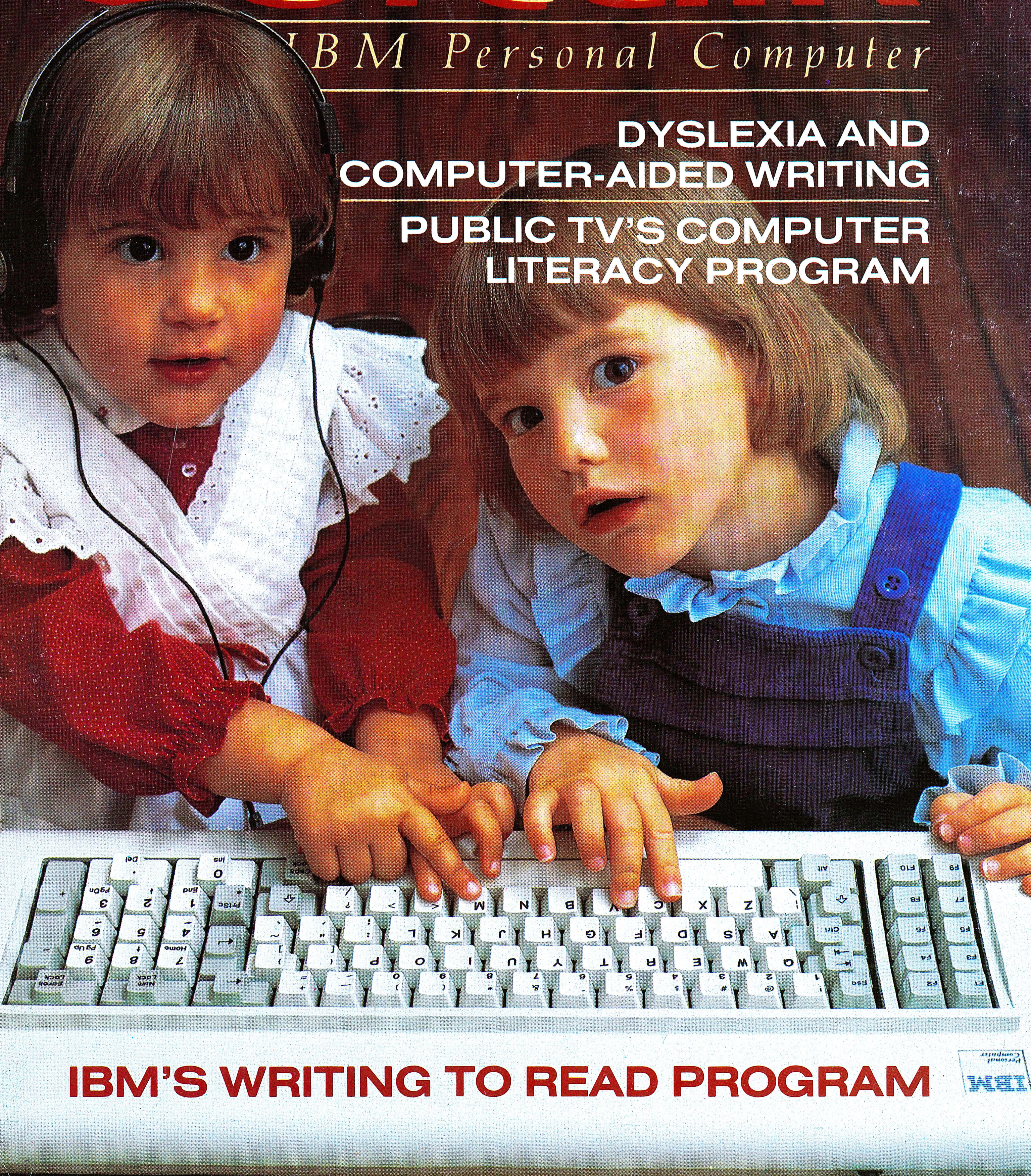
IBM Personal Computer



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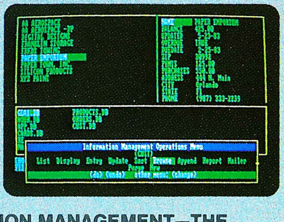
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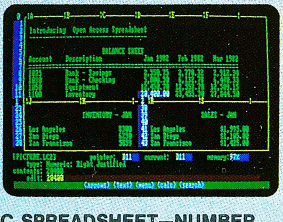
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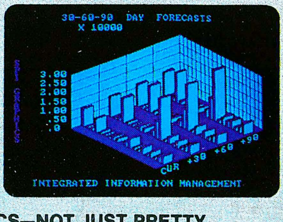
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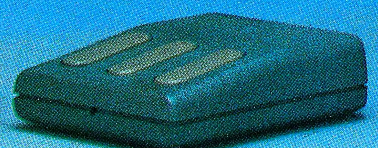

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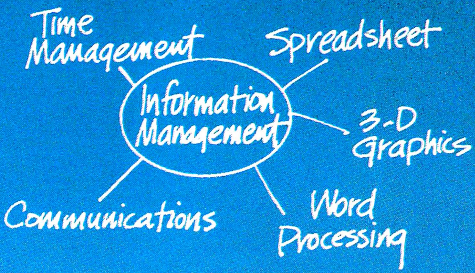

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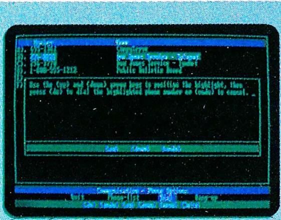

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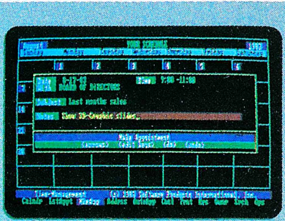

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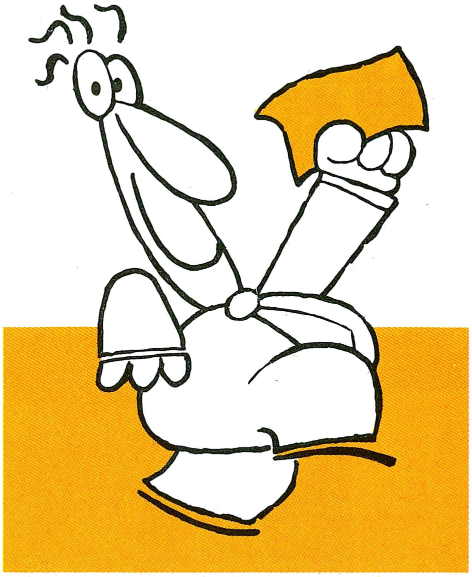

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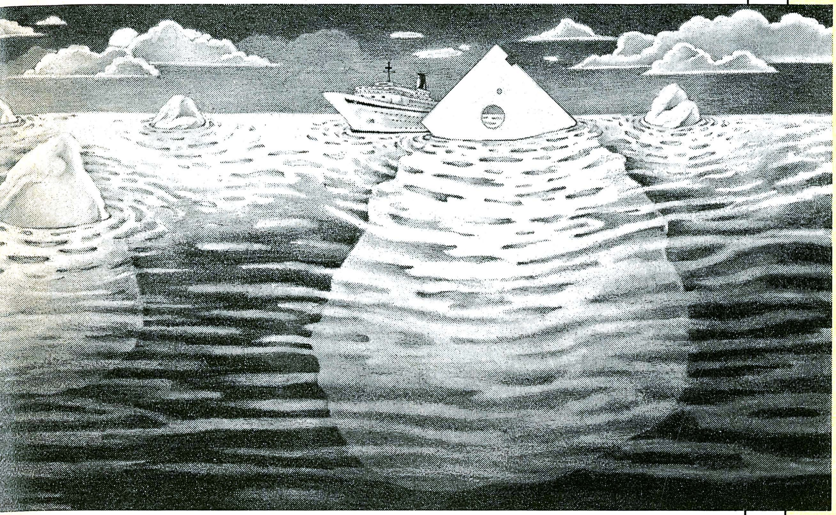

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When the first consignment of *Boron Moron*, which the Scots plan to repackage as *Haggis Hunt*, arrives, Angus Kintyre, the aging foreman, insists on having them stacked a special way: All boxes must be piled in square pyramids, and the number of boxes in each pyramid must be a perfect square.

A few youngsters try to get away with laying out the boxes singly, but Angus won't have it. "You cannae make a pyramid with but one box, lads!"

How many boxes were there in each pyramid? Put the answer on a post card (along with your name, address, phone number, and the goods you'd like to win), and send it to Nessie, Softalk for the IBM PC, Box 7040, North Hollywood, CA 91605—by July 17. The prize is $100 of software from the advertisers in this issue. If we receive more than one correct answer, we'll use our random number generator to choose the victor. Nì sinn seo air sgàth na sìthe.

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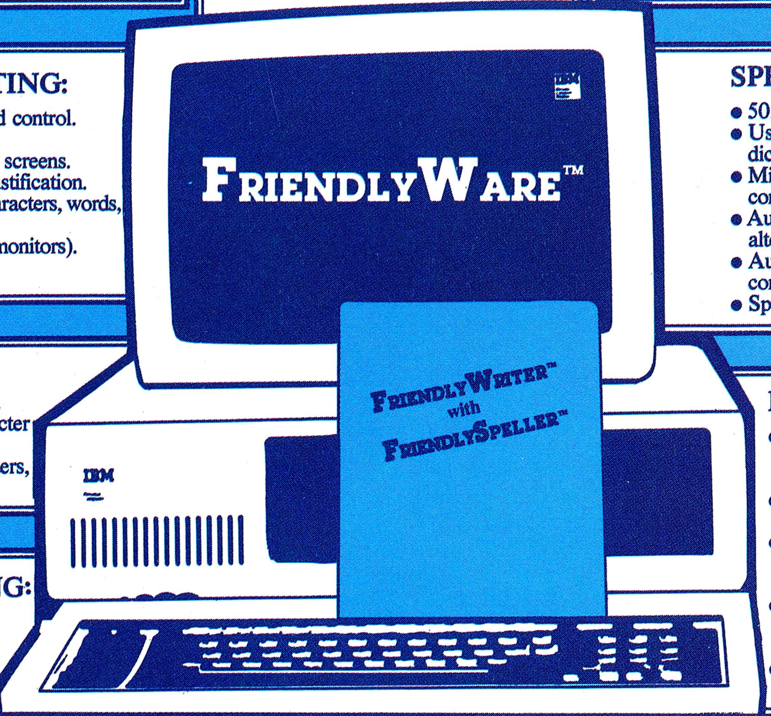

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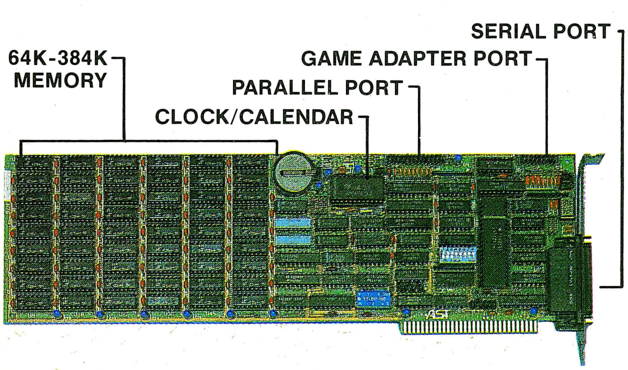

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More Help for the Handicapped

In the March 1984 *Softalk* you published a letter from Robert A. Hurlbert, a handicapped individual who experiences difficulty with the multiple-key combinations required to operate the IBM PC. In late 1982 I developed a keyboard utility, *Newkeys*, that was designed to overcome the layout peculiarities of the PC's keyboard. While I was developing that utility, I was contacted by the computer department at the University of West Florida. They had a handicapped student who was only able to press a single key at a time. The program I had developed was adapted to help this student use the PC. The adapted version changes the control, alt, and both shift keys into toggle-type switches similar to the num lock and caps lock keys. This allowed full use of the PC by an individual who could only press one key at a time. It does, however, require that the individual remember the state of these keys.

I will supply the version of *Newkeys* adapted for the handicapped to handicapped individuals if they will send a disk and $2 to cover postage to 1021 Moores Mill Road, Auburn, AL 36830. Please include a simple statement as to the nature of the handicap, as this will help me with the IRS.

Charles R. Bisbee III, Auburn, AL

Parity Check 1 Problems—and Solutions

I am responding to John Helle of Chesterfield, Missouri, who wrote in the March *Softalk* that he had parity check 1 problems.

I had the same problem and have found a solution. When the problem started, I also took my machine to the local dealer, and they couldn't find the problem. Later that same day, a friend said I should check my boards for memory chip "creep." I did, and several chips were quite loose. Dealers, it seems, don't necessarily check for chip creep. Once the chips were tightened, I no longer had any parity check 1 problems.

I keep my PC in a moderately cold room. Using the computer warmed the boards and caused them to expand; the intervening cold periods caused the boards to contract. I find keeping the computer room between 50 and 55 degrees helps avoid the expansion-and-contraction problem. Other PC users in my area have had Mr. Helle's problem, and this solution has worked for them.

Dirk Willem Dijkerman, Groton, NY

I have recently recovered from several days of being down with a parity check 1. The error was always generated when I tried to run a custom-made program that my company supplied. The program had been running properly for seven months, and then one day all I got was parity check 1. The home office analyst told me it was a keyboard problem. I spent some time with our dealer's service technician, and he couldn't find a hardware problem. He suggested I recopy all the data to my hard disk.

I retyped the batch file with the echo on so I could follow the order of the programs being run, and this allowed me to see which program caused the error. I finally isolated the program that always generated the parity check error and solved the problem by recopying the program to my hard disk. I have had no problem with this error since then.

I don't know the source of the error but evidently something caused part of one program to be destroyed or to misfunction. My advice is don't be afraid to ask lots of questions and always recheck your software.

Dilworth C. Brinton, Jr., Mesa, AZ

I don't know if John Helle has an AST board or is using their print spooler, but I had a similar problem and was assured that I had a bad chip by the dealer's service personnel and assorted local hackers.

Suspecting that the parity check error was associated with the spooler, I obtained a new spooler (version 4.0) from AST and haven't seen a parity error since installing it.

David M. Greene, Stamford, CT

When I first started using my system, I was in the middle of an advanced Pascal course and was using the p-System. I already had the majority of my then-current assignment completed on the school's Apple, and I could hardly wait to convert to the PC.

I spent many hours keying in the program (a text processor), and my system would be up for six or seven hours straight. Somewhere in the four to five hour region, I would start getting parity check messages at the end of a compiler list-writing operation. I first believed the errors to be hardware-related and, having a terrible case of the New User Scareds, promptly took my system back to the dealer.

The technician confirmed my own diagnosis that there was no fault. A call to Boca Raton confirmed this and yielded this interesting tidbit: Some new systems with the 256K motherboards may not recognize the game adapter, if one is attached, and the diagnostics routines

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MEGAHAUS CORPORATION/5703 Oberlin Drive, San Diego, CA 92121/(619) 450-1230 may not find the adapter either.

In pursuit of the parity gremlin, the technician and I swapped the motherboard in my system for a new one and installed all my adapter cards in a different system. That took both systems out, with persistent parity errors. The fix was a matter of checking the slots in the motherboard and ensuring that all adapters, and particularly the game adapter, were well seated and that we had made proper contact on all slot connections. Having done that, and a what-the-heck-let's-clean-the-motherboard-too, exit parity check messages, stage left.

The cause of the parity check errors? Not too sure.

The fix? Tighten connections to adapters, and if the diagnostic routines fail to detect the game adapter(s), make the correction when you get the diagnostic routine's message concerning its findings. According to Boca Raton, there had been systems that for unknown reasons absolutely refused to acknowledge the game adapter, ultimately requiring the replacement of the system board.

Now I only get parity error messages under the p-System, and only when I type ahead from the command level, quit the editor, update the file, and run or compile the workfile. Apparently the version IV.0 compiler attempts to append leftover or typeahead commands from the command buffer onto the end of the code file. In any event, I still get consistent CRC parity errors in the form of bad block messages, usually placed near the end of the code file. This requires scrapping the code file, examining the bad block(s), and fixing them. The parity error rate is worsened if I use a compiler directive to write the output listing to disk—the error will always occur if I use this kind of directive or type ahead.

I find that if I don't type ahead when quitting the editor, updating the work file, and running the program, or when compiling the code, I don't get the CRC parity errors. If I let the system complete the commands before issuing another, I won't run into the CRC parity errors.

F. L. McClellan, Santee, CA

Why APL?

Since first receiving *Softalk* about a year ago, I looked forward to the day when you would do an article on APL. Now that you have done such an article ("APL: A Pretty strange-looking Language," by Bruce Filbeck, March 1984), I am disappointed that the author did not completely do his homework and did not give a clear picture of APL, why it was created, who uses it, and for what reasons it is used.

To correct a few omissions: APL was developed by a mathematician named Ken Iverson as an alternative notation to the one we regularly use in algebra. The outcome of his and others' labor was a language that allowed algebra to be expressed in a consistent, syntactical way, as opposed to the way we learned to express algebra. For example, two plus two and two to the power of two have very different syntaxes. There are schools that use APL to teach algebra and calculus, as there are textbooks to assist that instruction.

In the world of computer programming, people who need fast results primarily use APL because programming is generally 75 percent faster with APL than with most other sequential languages. Financial analysts, oil analysts, and policy planners look very favorably on APL because of these attributes.

The only other criticism I have of your article is that you mistakenly mention IBM as "the most prominent provider" of APL for the PC. STSC has the most widely accepted APL for the PC, and it has been on the market longer than both IBM's and Watsoft's versions.

Gregory Schwartz, Philadelphia, PA

Contest Comment

Great magazine, but I'm tired of waiting for a challenging contest for programmers.

Here's a suggestion. Ask your readers to write a Basic program that creates an ASCII file copy of itself. *Exactly!* The only rule is that

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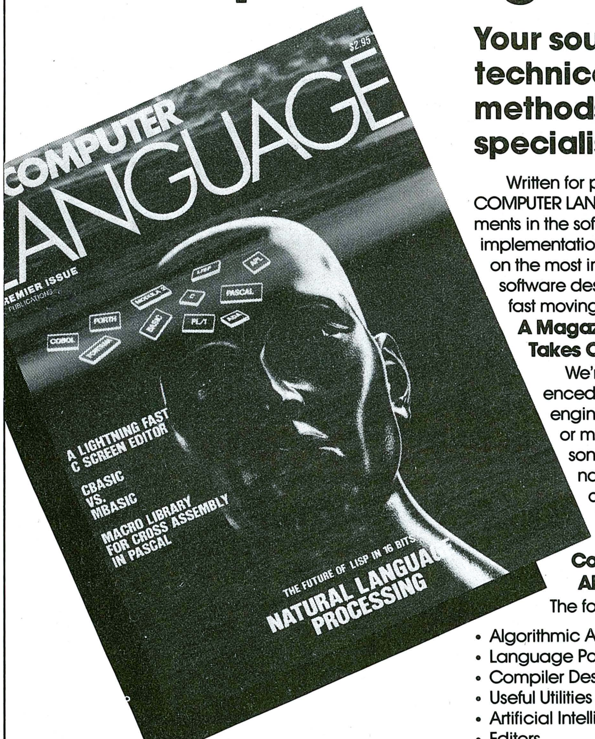

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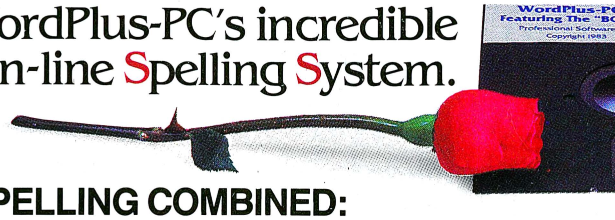

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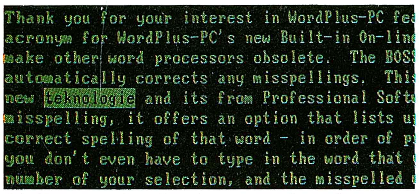
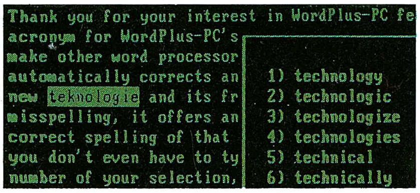


```
Thank you for your interest in WordPlus-PC fe
acronym for WordPlus-PC's new Built-in On-lin
make other word processors obsolete.  The BOS
automatically corrects any misspellings.  Thi
new teknologie and its from Professional Soft
misspelling, it offers an option that lists u
correct spelling of that word - in order of p
you don't even have to type in the word that
number of your selection, and the misspelled
```

At the touch of a button, virtually anytime during typing or after the creation of a document, The "BOSS" locates and *highlights misspelled words* on your screen. The "BOSS" can even check the spelling of a word directly after it's been typed in.

IT SUGGESTS



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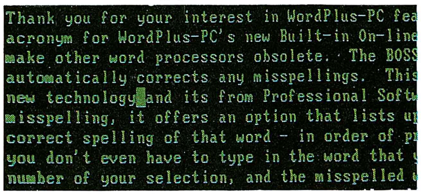
Thank you for your interest in WordPlus-PC fe
acronym for WordPlus-PC's
make other word processor
automatically corrects an    1) technology
new teknologie and its fr    2) technologic
misspelling, it offers an    3) technologize
correct spelling of that     4) technologies
you don't even have to ty    5) technical
number of your selection,    6) technically
```

When a word is misspelled, the user can ask The "BOSS" for suggestions as to how to correctly spell the word. With only one keystroke, The "BOSS" will display, in a dynamic on-screen window, up to eight *spelling suggestions in the order of probable phonetic correctness.*

IT CORRECTS



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make other word processors obsolete.  The BOSS
automatically corrects any misspellings.  This
new technology and its from Professional Softw
misspelling, it offers an option that lists u
correct spelling of that word - in order of p
you don't even have to type in the word that
number of your selection, and the misspelled
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And The "BOSS" *Auto Correct* feature enables users to "fix" these misspelled words directly in text with a single keystroke. The "BOSS" is a total spelling system that Checks, Suggests, and Corrects your Spelling. All built-in.

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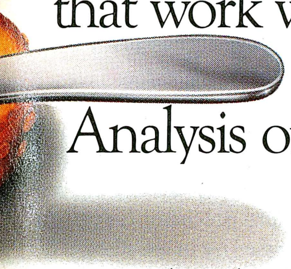

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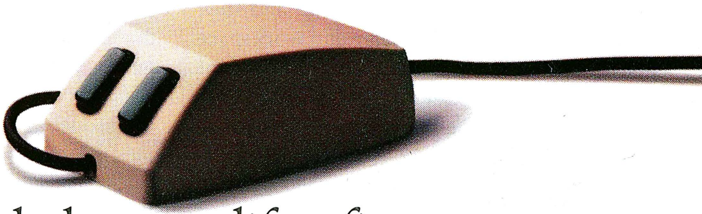

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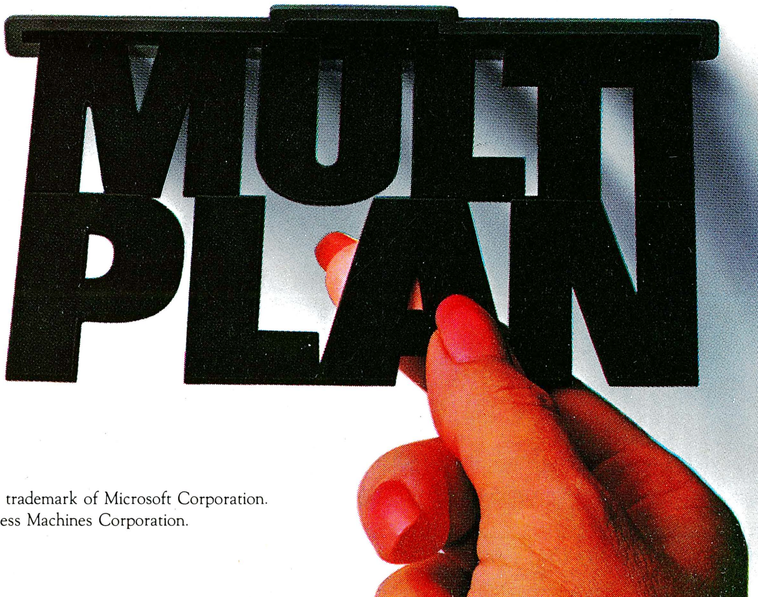

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the program cannot read any input files.

I promise not to enter or tell anyone the answer.

John Mudd, Casselberry, FL

Nice idea, but the contest judges would go crazy trying to pick the winners—imagine inputting several hundred Basic programs; we couldn't just take your word that the program ran. Got the idea? How about this month's Bide a Wee Contest *to challenge you? And if that doesn't stimulate you, we were thinking of having readers send in C programs to cure cancer or one-line Basic programs promoting world peace or. . . .*

Turtle Racing

Mark Bridger did an excellent job reviewing the four commercial versions of Logo available for the IBM PC. There was, however, one very glaring error. If the best that Logo could do on the PC was to address on 192K, there would be no reason for it to exist—all that horsepower with no place to go. Both Dr. Logo and IBM Logo can provide all the power and workspace one could want by tapping the potential of fixed disk systems. See page 1-24 in the IBM Logo manual and the preliminary information supplied with Dr. Logo to see how hard disks can be used. Both Dr. Logo and IBM Logo will use up to 256K of installed memory.

PC Logo is, indeed, limited to 128K maximum. It reminds me of my 1979 Trans Am: 400 cubic inches, 220 horsepower, with 130 mph laps on a road-racing course. But other than the race track, there's just no way to use that performance. PC Logo has provided some excellent features, but it's sort of like giving me a Trans Am to drive during rush hour on a Los Angeles freeway.

James H. Muller
President, Young Peoples' Logo Association
Richardson, TX

The Great Escape

There's an apparently universal belief out there that one must go to great lengths (such as using Basic or the DOS *prompt* command) to embed the escape character in a DOS file.

In DOS 2, the much-maligned Edlin line editor actually gives us a way—shall we call it a meta-escape command?—to enter control characters without executing them. The magic command is control-V. To quote the DOS 2.0 manual (page 7-11): "To enter a control character, press control-V, then enter the desired control character in upper case. For example, the sequence control-V followed by Z generates the control character control-Z."

And it works, too. The combination to enter the escape character is control-V followed by [(the left square bracket). The screen will show ∧V[when you enter it, but if you list the file after you've closed it, you'll see ∧[, which is the control-key version of the ASCII character 27 (decimal), otherwise known as escape! By the way, one place you can find out which control key combinations correspond with which ASCII codes is in the IBM *Technical Reference* manual in the "Keyboard Encoding and Usage" section; see also Appendix C, "Of Characters, Keystrokes, and Color."

Unfortunately the control-V method doesn't work in Command.com, so you can't use it if you're creating a file with *copy con:*. Happy escaping!

Klause Krause, Santa Clara, CA

See June's "System Notebook" for more about using the prompt command to embed the escape character.

XyWrite II

The review of *XyWrite II* in the March "Processed Word" left me with an uneasy feeling. I've been using this word processor for several months and am impressed by its excellence; it's a program that makes sense. Its structure is logical and its presentation clean. It's easy to use once learned, and it's fast and flexible.

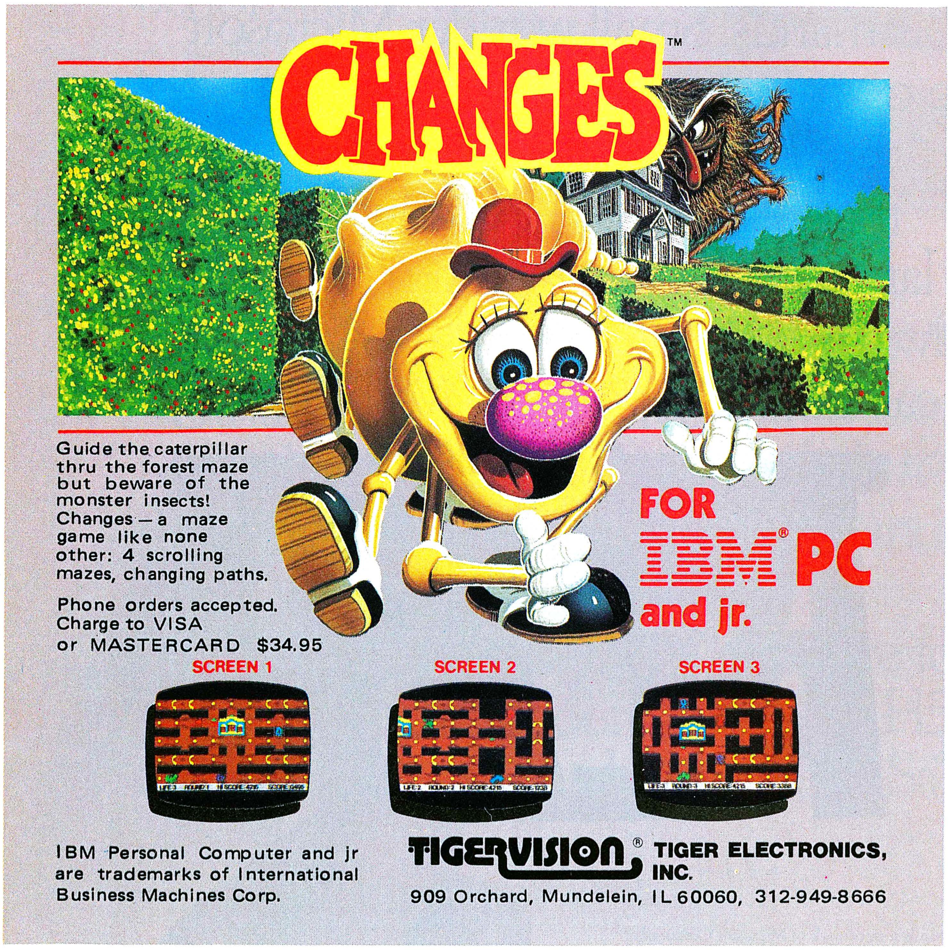
However, my overall impression from the review is that although the Datzes point out several of the strengths and useful features of *XyWrite II*, they were projecting an unnecessarily negative attitude toward the program. They overemphasized some minor flaws and inconsistencies in the program and criticized it for not having features that some mythical, ideal word processor has.

For example, the Datzes harped on the lack of page definition in *XyWrite* files. This criticism isn't relative to the *XyWrite* system, which treats the document—which can consist of more than one file and even more than one disk—as the working unit. Page definition is added when needed as part of the formatting and printing process. At that point the user can review or print a specific page or pages.

I also take exception to their implication that *XyWrite* is too technical and that its lack of menus and prompts detracts from its value. I think that many of us are educated and capable and prefer the flexibility and greater efficiency of command-oriented systems. I also think that well-written, well-organized documentation that provides conceptual orientation and a complete and accurate set of rules for the operation of the software is more important than help screens and tutorials.

Diana Herron, San Diego, CA

The Datzes reply: *Hey, we're on your side. On the whole, our review of* XyWrite II *was very positive. However, no program can please everyone all the time, and people who like their software with a lot of menus and prompts will probably be happier with another program.*



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This price comparison is based on the Suggested List Price as of 2.22.84 for the IBM Color Graphics Adapter.

As for the things we criticized, XyWrite II-plus, *XyQuest's new, enhanced version of* XyWrite II, *takes care of most of them—including the lack of page-break indicators.*

Beginner Horror Stories

I was aghast at reading in the March "Beginners' Corner" that you are advocating the "simple" and "easy" *diskcopy* command to beginners. This command is so simple and easy that users can blank out their serialized master disks quicker than they can blink an eye, only to face expensive reloading fees and weeks of downtime. Please pass on to your readers the other side of this DOS controversy, along with the following horror stories.

Horror Story 1 concerns a 800-Software customer who got *WordStar* for his PC. The program comes on two disks, and he knew he was supposed to wind up with all files on one disk. He put the master 1-of-2 in drive A and 2-of-2 in B and typed *diskcopy A: B:*, thereby replacing the information on B with the information on A. Cost: $150 to reload master disk two-of-two.

Horror Story 2 concerns someone who got three masters in a program and wanted to make straight copies. He carefully put the master in A, a blank disk in B, and typed *diskcopy B:*, at which point the program transferred the entire blank disk in B to A.

Now, instead of doing something simple like check the directory, he did a *chkdsk* on the two disks—the message came back that both disks were exactly the same. "Wonderful!" he cried, and then did exactly the same operation on disks 2 and 3. Cost: $150 x 3 = $450 to reload three masters.

Part of the problem here is that there are no messages connected with *diskcopy* procedures. If you copy files the recommended way, in file-copy mode, you see the name of each file as it's being copied. But *diskcopy,* with its entire-disk approach, just copies without comment.

Also, most master disks (except games and some copy-protected programs) come without a system track installed. Therefore, if you use *diskcopy,* you still won't have any system tracks, and the disk still won't boot. You have to reformat and copy again.

If you have a double-sided drive and copy a single-sided master disk—which almost every master is!—your copy will also be single-sided, and you'll lose half your storage space. The only way to get full storage space is to reformat and recopy.

A final reason to eschew *diskcopy* commands has to do with data disks. In all the previous examples we've been talking about master program disks. But if you have a data disk to which you've been adding and deleting, it's likely that a single file is scattered over five to ten very different locations on the disk. If you *diskcopy* your data disk, the information will wind up as scattered on the copy as it is on the master. Do a file copy, however, and the info will be picked up from the scattered locations and placed sequentially in your new copy. The copy will be better than the original, and faster, too.

A final horror story: A customer recently called me to say something was wrong with his new program. While troubleshooting, I found that he was trying to install his master disk. I explained to him that these masters are never used for anything except making copies. I asked why he hadn't made a copy first, and he told me that he wanted to see if it worked before he made backups.

I explained to him that not only are there no system tracks on master disks, but that he could erase or otherwise mess up the master and have to pay $50 to $150 to get it reloaded at the factory. "That's no problem," he told me. "I have a write-protect tab on the notch." "And this is the disk you were trying to install?" I asked him. Yup. He couldn't tell me how he thought the computer could write the installation information on the disk with the tab on.

Dan Hawkmoon Alford, Berkeley, CA ▲

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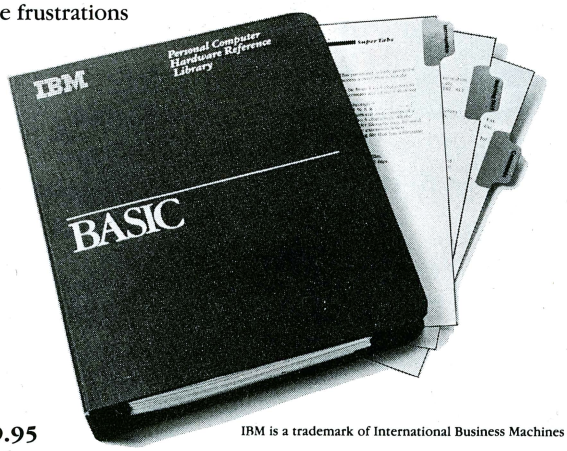

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Introduction
Starting DOS
Commands
EDLIN
LINK
DEBUG

CONTEST WINNERS

Sir Edmund Hillary was the first to climb Everest, but C. Michele Ray, of Indianapolis, Indiana, will go down in history as the winner of the Abominable Contest.

The computing hours spent by *Softalk* readers on this problem probably surpassed the efforts of the Japanese in their quest for the fifth generation. Some of the entries included equations worthy of a freshman calculus class. The programmers used every imaginable language; recognizable were Pascal, C, Logo, FORTRAN, assembly, *dBase II*, and, of course, BASIC.

Wrong answers ranged from 1 Yowling Yeti cartridge to 9,300,595 of them. That's a lot more cartridges than there are PC*jrs*, although maybe that reader figured the folks at Annapurna are as optimistic as IBM.

Michele's correct answer of 3,121 was achieved without the use of a computer, programmable calculator, slide rule, or abacus. Though she doesn't remember exactly how she found the solution, she claims to have relied primarily on trial and error. If it worked for Edison with the electric light, well, why not? ▲

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QUESTIONS & ANSWERS

by Nancy Andrews

Q: In the December 1983 "Boards and Buses," Kevin Goldstein suggested a way to have the computer look for the Command.com file on the hard disk in drive C. I have been trying without any luck to accomplish this with the *Comspec* command. Goldstein's approach, using the *shell* command, works perfectly; however, I don't have an XT, but a Tallgrass hard disk connected to my PC. When I boot my computer I have to boot from a floppy, which then runs a device driver that enables the hard disk. In executing the *shell* commands, the computer goes to look for the Command.com file on drive C, but drive C is not initialized via the device driver to make it work. I would greatly appreciate any help you can give me with this.

Thomas G. Donovan

A: I think we have an easy answer for you on this one. Perhaps if you just change the order of the commands in your Config.sys file, your problem will be solved. The statement:

```
device = [specify hard disk device driver]
```

must precede the *shell* statement. This way your drive C will be enabled before the system looks for Command.com. If this doesn't solve the problem, let us know.

Q: It would be more convenient for me not to have interactive debugging in BasicA. Is there a simple way to make Basic proceed on to the next error without fixing the preceding error? Even better, I would like a printout of each line and the error message. Is there a way I could do this?

Cheryl Ellis

A: What you can do is use the Basic *on error* command. At the beginning of your program put the line:

```
10  ON ERROR GOTO 1000
```

Then have line 1000 print the error line number and error message and line 1001 resume program execution at the line following the line with the error.

```
1000 PRINT ERL: PRINT ERR
1001 RESUME NEXT
```

This will work well in some situations. However, since Basic checks syntax and executes instructions at the same time, certain errors will definitely affect program execution and perhaps produce additional error messages. For example, if you have an error in a statement that controls a *for* loop and then resume execution at the next line—presumably the body of your *for* loop—you'll generate a lot of errors that you would avoid had you fixed the *for* loop control statement first. So, use *on error* wisely.

Q: I find it very frustrating that, after the Command.com file has been wiped out in the high end of storage, DOS insists on reading it back in from the disk in drive A, even though some other drive may be the default.

I often run a RAM disk as drive C, and it's very convenient to load my whole system disk—containing an editor, Basic, and a number of utilities—onto this drive and make it the default drive. But when Command.com gets zapped from memory, I have to reload a DOS disk into good ol' drive A so that DOS can satisfy itself in its own way.

I would like to know how to modify DOS to make it read Command.com from the current drive instead of reading it in from the A drive.

Thomas N. DeForest

A: DOS can be induced to read Command.com from the RAM drive, and it requires only that you add two lines to the end of your Autoexec.bat file after you have copied Command.com into drive C.

```
SET COMSPEC = C:\COMMAND.COM
COMMAND /C COMMAND
```

Some information about this can be found on page 10-9 of the DOS 2.0 manual. As far as we know, you can't do this with DOS 1.1. If any readers have solved this with 1.1, please send us the info and we'll pass it on. Otherwise, we'd recommend upgrading to 2.0; its added functions are well worth the $60.

Q: I have a PC and a NEC Spinwriter 3500Q printer. I bought a Courier 72/Manifold thimble to use with the printer, but I can't get the thimble to type the Manifold type (which isn't a pitch difference but a type difference). NEC advises me that I need a *WordStar* patch. MicroPro advises me that changing the type is a NEC function. Changing the pin setting on my printer results in a pitch change but not the type change.

Second, my BPI accounts receivable reports are continuous—no page pauses. Sometimes my paper isn't aligned, and if I stop printing it takes almost a page for the printer to stop, and it states on my report, "terminated by operator." Is there a BPI patch to effect a page pause?

I realize these are questions that NEC, MicroPro, and BPI should answer, but no one has given me a reply that gets me anywhere.

Karen Dyer

A: Unfortunately, we can't do much about your printer. The NEC 3550 ordinarily would be able to access the Manifold type. The Q after the 3500 indicates that your printer has a Qume interface, which means that another vendor added firmware to your NEC to make it emulate a Qume printer. Because of this, it's impossible for NEC to tell you how to make the printer access the different type. There is a company in California called Intec that buys and adapts NEC printers, changing them into NEC/Qumes. You might try contacting them to see if they can help. There is a rumor that ComputerLands in Los Angeles were selling the NEC 3500Qs to customers and claiming they were IBM-compatible and that NEC would support them, so you may not be alone.

Your second problem is easier to solve. Apparently, to stop printing you were using function key F1, which is intended to terminate a printing job. However, you would be better off using F7 and F9; F7 (like *WordStar*'s *p* command) stops the printing operation, and F9 resumes printing. If you use F7 and F9, you won't get the termination message or the extra linefeeds.

Q: I want to disable the blinking cursor. It's very distracting. Many of my friends agree. How can we make it be just a straight, unblinking line?

S. J. Wendling

A: Cursor blinking is hardwired in. There are times that we'd like to turn it off too, but we don't know any way to do it. So get some Excedrin and carry on.

Q: I have some questions about the NCI version of the UCSD p-System (version B1). My current memory configuration consists of 256K achieved by adding a 192K AST board to a 64K base.

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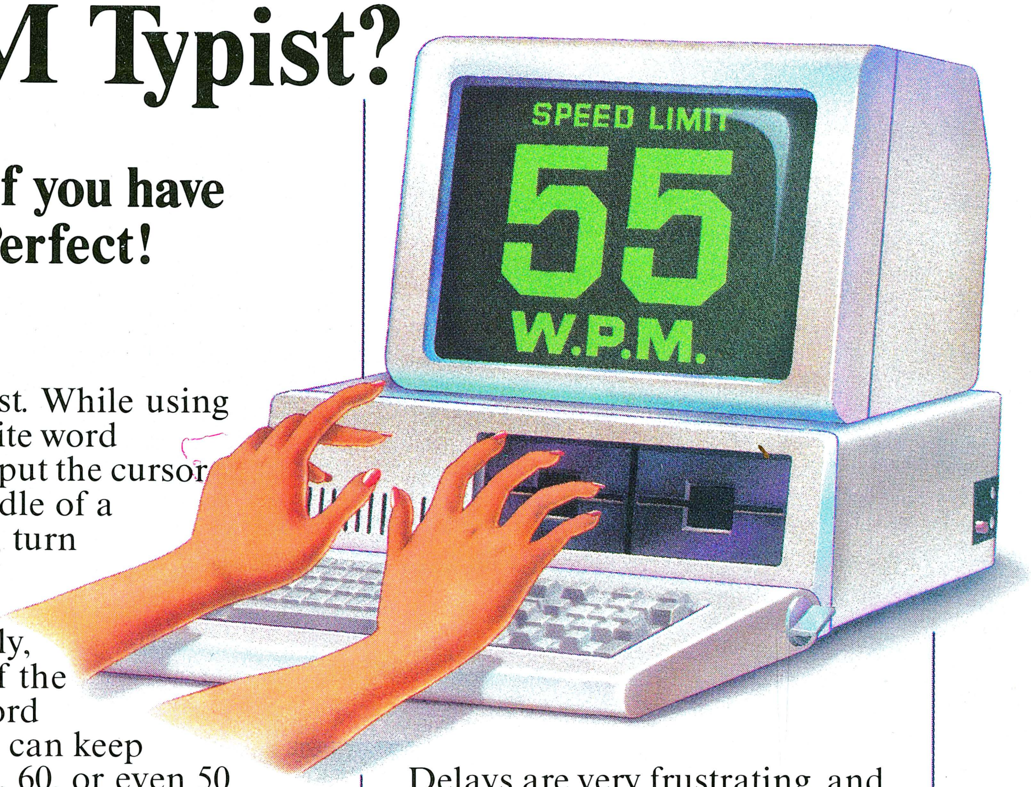

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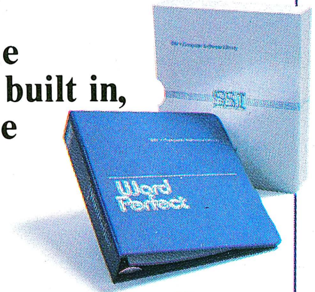

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When I reset the system, the time and date are displayed under the NCI logo from the AST clock. How do I access the AST clock via a Pascal command? Apparently, the *time* command uses the system clock and does not recognize the AST clock.

When I boot the system, it would be helpful if the System.editor and the System.compiler files were transferred to RAM automatically. Perhaps you know of a straightforward way to do this. It has occurred to me that properly programmed function keys may solve this problem, but I haven't found a way to do that yet.

Therefore, I have three questions: How do I access the AST clock from a Pascal program? How do I transfer the System.editor and System.compiler to RAM quickly?

Daniel G. Krivitsky

A: You're in luck—NCI supplies an AST clock routine that can be accessed through the *Caller* program. Include in the *Uses* declaration the Clock.cal code for the AST board. Then call Procedure CC_Get_Time. NCI says this is explained in its *Programmers' Guide to the p-System.*

You can transfer the System.editor and System.compiler files to RAM if you have at least 256K—which you do. NCI will do this automatically for you, depending on where these files are on your boot disk. Here's what you do. Create a boot disk that has the files you want transferred into RAM at the beginning of the disk—so first use the Filer to copy the editor and compiler onto a new boot disk. Then follow these files with the N-Boot file. This tells the p-System to copy everything automatically that precedes N-Boot into RAM each time you boot your system.

Q: I would appreciate your help in solving a very annoying problem we're having with our PC. When the computer is turned on, the pictures on the TVs in our home have a lot of static and are snowy. This problem is very bad on our local channel 5, and to a lesser degree on channels 9 and 12.

The computer is on its own electrical circuit, feeding directly into the main electrical panel. The CPU is separated from the main TV antenna by an outside wall, but it is only twenty to twenty-five feet away. The TVs on the main coaxial cable are most affected; but the condition still exists on a portable TV that has its own antenna. Thus, I am prevented from computing when my family is viewing. Please help!

Todd S. Deutsch

A: Your problem is radio frequency interference. Unfortunately, the outside wall is no help. Standard IBM equipment should not cause these problems, but add-ons don't necessarily meet the same standards. Probably the interference comes from cables that are not shielded—perhaps an unshielded printer cable; if you happen to have removed the cover of your computer and replaced it without putting the screws back in, that could be the problem. So if you've tightened the screws and don't want to replace cables, the next best solution is some sort of surge protector—one that also offers RF noise protection. These should be available from almost any dealer.

Q: I could really use some help on a problem generated by your magazine. I'm basically a PC novice, but I can readily appreciate the advantages of John Socha's *Scrnsave* utility program for saving the monitor screen (*Softalk*, December 1983). However, when I run the com program with my RGB monitor, the only character that blanks out on my screen after three minutes is the cursor; the display remains.

I may be doing something wrong, or the key to adapting this program to my color/graphics system may lie somewhere in the corresponding assembly language program, but frankly the latter is Greek to me and I don't know Greek.

Howard Tint

A: Before we had a chance to contact John Socha, we received another letter from Mr. Tint answering his own question. We print his solution here, in case other readers have similar problems: "I had neglected to report in my letter that I was using a USI Multidisplay Adapter Card in my system and that lever 4 of the onboard dip switch (S2) was set to off to prevent blanking the display during scrolling in the 80-by-25 color mode. This lever must be reset to more closely mimic the operation of the IBM color/graphics card in order for the Scrnsave program to work correctly. With this change everything works fine."

Q: There are many interesting Basic programs in your magazine, but none of them explain what memory areas they are peeking or poking into or why. For example, in the Basic Manual on page 4-205 it says:

```
IF (PEEK(&H410) AND &H30) = &H30
     THEN IBMMONO = 1
     ELSE IBMMONO = 0
```

Is location 410 an area in the registers, such as AX or DX? Why do they poke or peek at that location? I know it's to change the bits; what I don't know is what that memory location represents.

Another example comes from Joe Juhasz's "Basic Solution," December 1983.

```
1050 FOR KOLOR = 1 TO 3
1060 DEF SEG: POKE &H4E, KOLOR
```

What is at location 4E? Is *def seg* the same as *def seg = 0*? I suspect these areas represent the registers used in the Assembler but can't find any information on the memory locations of the AX, BX, CX, DX registers, or the stack.

Cheryl Ellis

A: Your first question deals with location 410. This is a location in memory, although it isn't a register like AX or DX. Location 410 contains the equipment-determination byte. By peeking at this byte (and *and*ing it with 30 to get the particular bit you need), you can determine whether the system has a monochrome or color monitor.

The byte at location 4E contains the default foreground color. By poking 1, 2, or 3 into this location, you can change the color of the text printed on the screen. It is necessary to use a *poke* rather than Basic's *color* statement, since in the graphics mode Basic's *color* statement only lets you specify the background color.

Def seg without an argument sets the segment to Basic's data segment or variable space. It isn't the same as *def seg* = 0; Basic's data segment is quite a bit higher in memory.

AX, BX, CX, and DX are among the 8088 microprocessor's *registers*. They're not part of your PC's random-access or read-only memory, so they aren't identified by numeric addresses.

Here's a letter from a reader who wants help locating a loan-amortization program. Perhaps you can help; we're including his address so you can correspond with him directly. He writes: "Can you or your readers help me find a comprehensive loan-amortization program? I would like a menu-driven program. I'd like to print customer name and loan number as well as loan terms, i.e., loan amount, interest rate, payment amount, and term of loan on the top of the loan schedule.

I'd like interest calculation options: normal (30/360-day), actual (365-day); payment and other options: interest only, interest-included payment, interest added to payment; quarterly, semiannual, annual payment options as well as monthly, balloon payments, odd days to first payment; to print totals per calendar year; and to print payment dates.

I have an IBM PC with 320K of RAM and two 320K disk drives. Send information to Walter E. Ollech, President, Schuster-Campman Abstract and Title Company, 161 East Fifth Street, Box 106, Neillsville, WI 54456.

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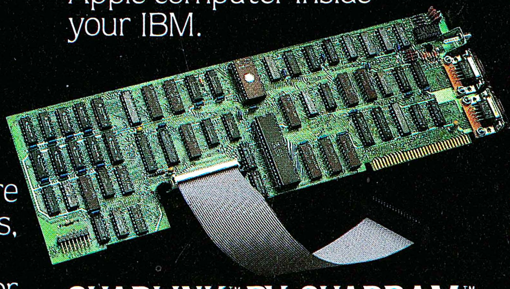

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Our response to Ideo Video and Tabs in Shabs (January 1984) about the IBM *Professional Editor* generated quite a few letters. Other readers using the *Professional Editor* may find the following information useful.

First, Robert Batten provides a solution to the color problem, but only after first airing a few complaints about *Professional Editor.* "The authors of the *Professional Editor* forgot the cardinal rule of software flexibility when they assumed everyone would have a color monitor. If you don't have one, you get an unreadable menu at the beginning of the program and have to reset the background color after exiting—even if you've selected the black-and-white option. A more logical approach would be to assume everyone had a black-and-white monitor, since all monitors are readable in this mode; then people with color tubes could paint their words at their leisure.

"I was appalled at the lack of support I received on the background color problem, so I assembled the entire executable image of Edit.exe, and, with the help of the *Technical Reference* manual and Debug, corrected the problem.

"The following steps will guide any user through this fix. It is for the large editor, not Edit64.exe; however, you may be able to follow this and find a solution for Edit64 as well.

"Load DOS; place your Edit disk in drive A and a blank disk in drive B. Log on to drive B and type:

```
COPY A:EDIT.EXE EDIT.FIX
```

You now have a copy of Edit.exe, named Edit.fix, on drive B. You need this, since Debug will not allow you to save an exe file to disk.

"Now, put your Debug disk in drive A and type:

```
A:DEBUG B:EDIT.FIX
```

At the Debug prompt (—), type *R* to display register values. Write down the value of CS; in my case, with 192K of memory, CS = 08F1.

"Now use the search function to find all occurrences of CD 10, which is the video interrupt in BIOS. Type:

```
-S CS:08F1 6000 CD 10
```

(substitute the value of CS on your system for 08F1). You'll see:

```
08F1:5C6E
08F1:5D08
08F1:5D13        (Third occurrence is the key. Write down
                 this address)
08F1:5D46
08F1:5D4E
```

"Let's unassemble the location where the third occurrence of CD 10 was found. Type:

```
—U 08F1:5D13
```

You'll see:

```
08F1:5D13 CD10   INT   10
08F1:5D15 BBD21C MOV   BX,1CD2
08F1:5D18 D7     XLAT
08F1:5D19 3C10   CMP   AL,10      08F1:5D1B ...........
```

Write down the address of the fourth line. I won't bore you with the rest of the unassembly, since it's not important. I'll tell you, however, that the line before INT 10 was MOV AH,0F, and this *is* important. When AH = 0F, interrupt 10 returns the current monitor type in AL. Note that CMP AL,10 is used by the author to decide which type of state to set later on. So we'll put MOV AL, 02 where CMP AL,10 is, and this will force the eighty-column B&W state to be set. This will work at exit as well as at the very beginning of the program. When you use your patched version of the Editor, note that now the Prime Page will show 2 as the preselected monitor type, and, if you wish, you can change the monitor type to color instead. This roundabout patch makes the program run the way it should have in the first place.

"Let's rewrite CMP AL,10. Remember the address you wrote down. In my case it was 08F1:5D19.

```
-E 08F1:5D19 B0 02
```

Now use —U 08F1:5D19 and check that the location where CMP AL,10 was now reads

```
MOV AL,02
```

To save this mess, type *W.* You'll see the message: *Writing E300 bytes.* Now type Q to leave Debug. Rename Edit.fix Edit.exe, type *edit,* and see what happens."

Reader Thomas Grizzard points out that if you start *Professional Editor* after exiting from either *EasyWriter 1.1* or *1-2-3* and don't reboot, the video display comes up normally and you can exit from the editor without display problems.

Another reader, Ted Mirecki, says that you can avoid the whole video problem by entering the command:

```
MODE BW
```

before starting the editor. He also explains the tab problem as follows: "The Editor inserts one character (hex 09) for each tab. This isn't a bug—it runs exactly as documented. It's also not a problem, but actually quite desirable. Some programs, such as the DOS *type* command, replace that character with as many blanks as it takes to get to the next tab stop; other programs, such as Pascal, replace it with a single space. However, DOS will expand to its own built-in tab stops, which are fixed at every eight positions. The Editor's default tab stops are the same as those in DOS, so the tabbing you get with the *type* command will match what you see in the Editor only if you didn't reset the Editor's tab stops to something other than the default. The solution is documented on page 9-14 of the *Professional Editor* manual: The *T* line command replaces each tab character with as many blanks as it takes to get to the next tab stop as currently defined within the Editor. To convert all tabs to spaces throughout the file, enter *T** in the line command space of the first text line of your file. After you save the file, its actual contents will match what you saw on the Editor screen and will be properly printed by any program.

"There is a penalty, however; the file will be larger because each single tab character will have been replaced by many blanks, and there's no way of reconverting the spaces back to tab characters. What I do is save the expanded file under a new name, print the new file, then delete it. That way the original file is kept in its compact form."

Finally, reader Michael Doob presents a way of modifying a Pascal program to expand the tab character used by the *Professional Editor.* The following program fragment contains the essentials for doing this:

```
CONST ESC = CHR(27); TAB = CHR(9); LF = CHR(10);
CR = CHR(13);
        PAGEWIDTH = 96; PAGELENGTH = 66; TOPSPACE
        = 6; BOTTOMSPACE = 6;
VAR TAB_STOPS: ARRAY [1..PAGEWIDTH] OF
        BOOLEAN;
PROCEDURE SET_TABS; VAR I:INTEGER;

BEGIN FOR I := 1 TO PAGEWIDTH DO
        IF (I MOD 8) = 0 (*OR WHATEVER CRITERION
        YOU WANT*) THEN TAB_STOPS[I] := TRUE
        ELSE TAB_STOPS[I]:= FALSE
END;

PROCEDURE INSERT_TAB;
BEGIN
REPEAT
        WRITE (PRINTER,' ');
        COLNUM := COLNUM + 1
UNTIL TAB_STOPS[COLNUM] (*IS TRUE*)
END;
```

Ideas along these lines can be found in Kernigan and Plauger's book, *Programming Tools in Pascal.* ▲

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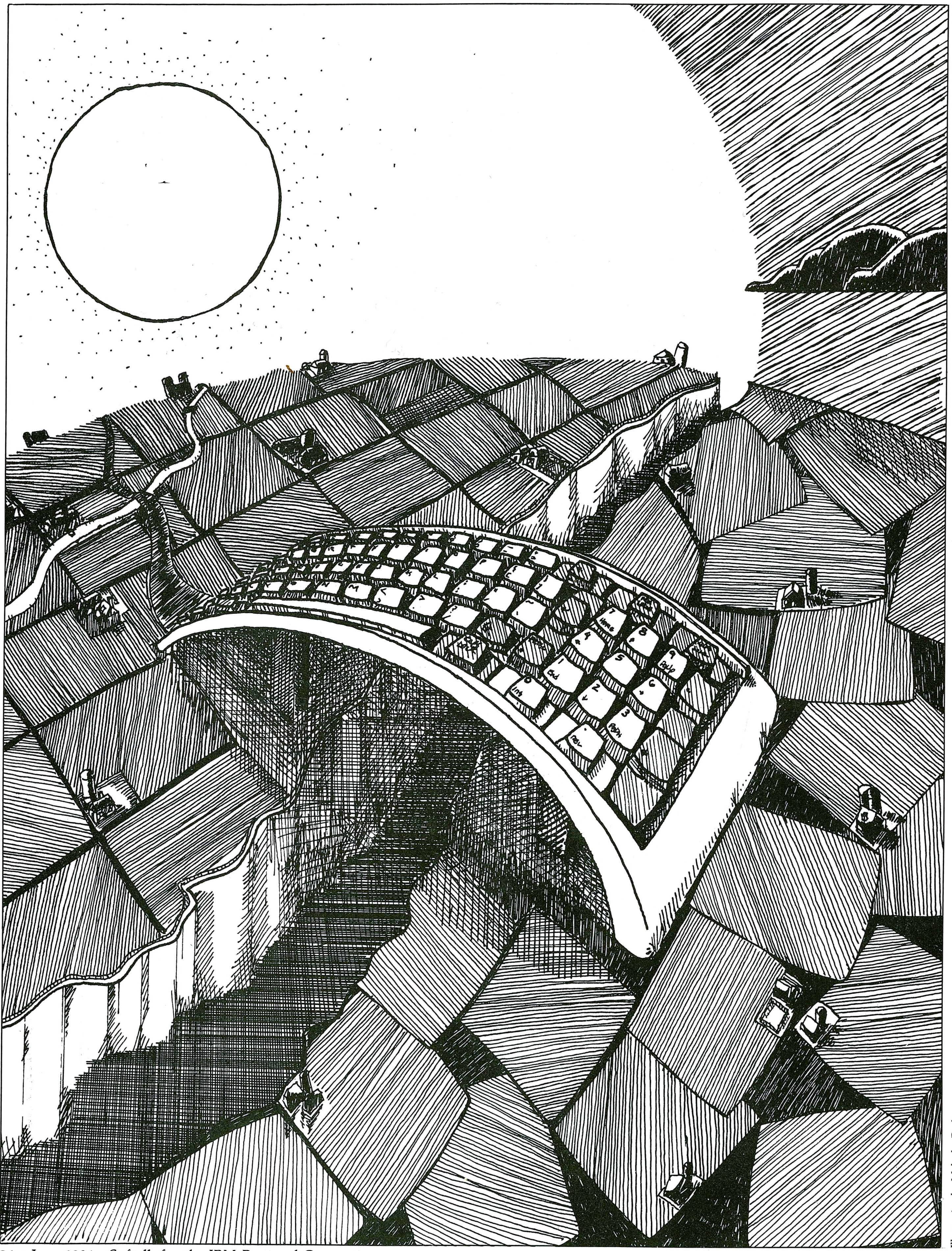
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BRIDGE TO CLARITY:

The Computer as Compensatory Writing Tool

Dyslexia is a label for a group of related developmental language problems having to do with reading—visual processing of language in all its symbolic forms—and writing. The most common indicators of these problems are the reversal and transposition of certain letters, poor spelling, short-term memory difficulties, and weak global organization skills. Dysgraphia, when it occurs, is usually part of a dyslexia problem. Dysgraphia usually affects the writing and drawing of all types of symbols, including analogical ones.

I'm dyslexic and dysgraphic. My interest in computers grew out of a quest to learn more about dyslexia. I wanted to find out what was going on inside my head that was making certain things hard.

By Richard Wanderman

As I explored the area of language-related learning problems, the network of ideas kept growing: the brain, neurology, problem solving, multisensory learning models, artificial intelligence, educational philosophy, compensatory tools, and finally, computers as compensatory writing tools.

Most dyslexics have a hard time using writing as their primary means of expression. Because of their problems with spelling, organization, memory, and logic, they tend to find the process of writing very slow going.

> **People who read my computer–aided writing . . .**

Fortunately, appropriate compensatory tools can make the process of writing easier and the end result more satisfactory. The newest such tools—microcomputers and word processing programs—change the writing process itself, thereby making it more enjoyable and satisfying to people who have developmental language problems.

The Problem. I read a line. Upon reaching the end of it, I see that I have a problem—I seem to have lost the beginning. So I go back to the beginning and reread, and this time I lose the end. Meanwhile, I may also be reversing letters within words, changing their meanings, or transposing words within a sentence, changing its meaning. When I'm writing, something similar happens. I type a first draft, and when I go back and reread it I discover mistakes. So I type a second draft to correct the mistakes I made in the first. But when I read the second draft, I am confronted with new mistakes; in addition to new clerical errors, which anyone might make, there are words spelled incorrectly that I had no problem with the first time. And so it goes. At times, I find this combination of problems pretty disheartening. How, I ask, do I manage to read and write at all?

But an amazing thing has happened since I started writing with a computer: People who read my computer-aided writing can't see what my precomputer writing was like. Computer-aided writing gives me the power to express my ideas without having them undermined.

Initially, I was overwhelmed with just the power of the delete key. Electronic editing alone is worth the price of the computer. Just being able to go back and fix the transpositions, typos, and spelling problems—even one by one with the use of a dictionary—is easier than rewriting the piece, which for the dyslexic is an endless cycle.

Writing is still a struggle, but a much more enjoyable and productive one now. Because I can now reference my own written ideas and build on them, I can develop my ideas more fully. This in turn gives me a feeling of power, intelligence, and self-worth that not only feels great but pulls more writing out of me—a much more positive cycle.

Building Blocks. When I was a child, my favorite toys were blocks. Later I made a ceramic sculpture that was stackable and rearrangeable (clay blocks). I now enjoy Logo, *Rocky's Boots*, and *MacPaint* because they facilitate learning through building (high-tech blocks).

The building process is an important part of what I'm exploring here. Learning and using language is a building process: We build words with letters, sentences with words, paragraphs with sentences; and we build ideas by manipulating all of these. We build ideas with other ideas. We debug or change older ideas to handle new ones, and we alter new ones to fit the old. The result of this is an aggregate, where we might or might not see traces of the original ideas or the building process.

I'm putting this piece of writing together by building large language/idea structures out of smaller ones. The computer-aided writing process lends itself to language/idea building because of the ease with which things can be moved around, regrouped, and changed. This new opportunity to experiment with language formation is opening up writing as a means of expression to a wider audience than ever before, including people with dyslexia.

What's Preventing the Connection? There's a lot of attention being paid to the use of computers as prosthetic devices for physically disabled people. But because of the lack of understanding and the common misconceptions about problems like dyslexia, less attention has been paid to computer applications for this area. Why aren't more dyslexic adults finding out about computers and their use as writing tools? Some thoughts:

> **. . . can't see what my precomputer writing was like.**

- Dyslexic adults are relatively invisible. Many of them aren't aware even of what their problems are, let alone of ways to remediate them.
- Because dyslexic adults aren't a homogeneous group and don't have a single advocacy program, it's hard to spread information among them.
- Many dyslexic adults have grown comfortable with their limitations. They're not interested in rocking a limited but steady boat. It's hard to see a need to write after having successfully avoided it for so many years.
- More educational attention is focused on children, out of the assumption that adults are either finished with their formal education or already functionally educated and less in need.
- Computers and computer literacy are being packaged in a way that prevents many adults from visualizing a personal use for computers. This includes the misconception that computer literacy means the ability to write code. Many dyslexic adults who might otherwise express an interest in computers don't, because writing code scares them.

Language Fluency Equals Intelligence? There is an assumption that language fluency is the most accurate indicator of an active thinking process. If a person (especially an adult) has problems with written expression, a common conclusion is that there's something lacking in his intelligence. Verbal expression is our taken-for-granted medium for sharing thoughts. But to assume that use of verbal language gives us an accurate picture of thinking processes is to ignore all the other ways man has devised to express himself.

Verbal language use is analogous to screen activity in computers. The screen is our taken-for-granted window on the activity of the machine, but there are other windows. Some terminals (Teletype printers, for example) don't have screens. Computers can be grinding away doing complex calculations with absolutely nothing showing on the CRT and nothing happening on the Teletype.

Two things:

- It helps for dyslexics to develop fluencies in languages other than verbal in order to build expressive confidence that is transferable to verbal language learning.
- It is important for dyslexics to find alternative ways (such as multisensory remedial reading and computer-aided writing) of learning and becoming fluent in verbal expression, because verbal expression is so important as a learning and sharing medium.

How Does Writing with a Computer Help the Dyslexic? The most important process change is that writing (forming ideas with words) and printing are now separate operations. No more complete rewrites due to one mistake. Electronic editing is so painless that we can spew out the most amazing mess and still whip it into shape relatively easily. Computer-aided writing takes advan-

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tage of the modularity and constructability of language. Editing this way is like sculpting in clay—building, cutting, rearranging— all happening simultaneously and with the knowledge that if we make a mess, a backup copy of the original is waiting.

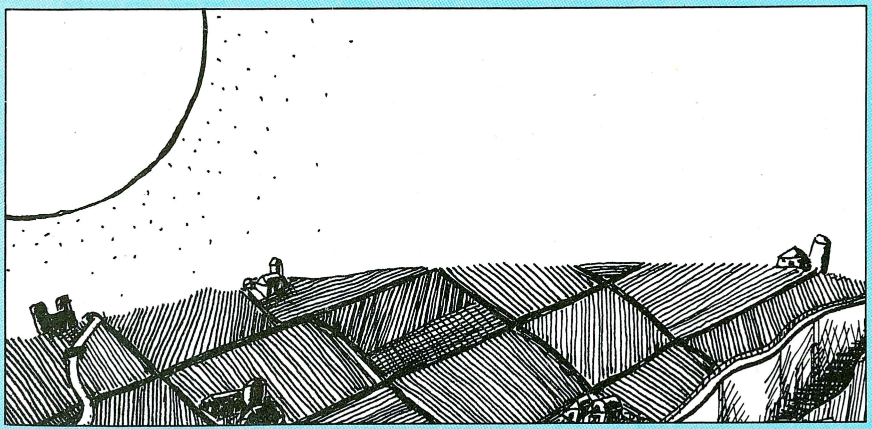
> **The computer is a programmable extension of a lot of things . . .**

Writing is a learning-by-doing activity. So is reading. Reading and writing are mutually dependent—they feed each other. The chicken/egg problem facing dyslexic people is that they aren't reading for models and they aren't learning by doing writing. A computer can help break the block by making writing enjoyable enough so that a dyslexic person can produce some finished pieces of writing without too much resistance. This feeds more writing, which feeds more learning, which feeds confidence.

What's in a Name? The educational system calls dyslexia a learning disability rather than a specific language problem. That's wrong; I'm dyslexic, but I'm not a "disabled learner." I do have a hard time with reading and writing, and I realize the importance of both in other learning activities, but I've found ways of compensating and learning the same or similar information in different, sometimes nonverbal, ways. Many dyslexics develop unusual learning styles and problem-solving strategies. But is a different learning style a disability? Disabled relative to whom? And who decides whom? What's the norm, anyway?

(There's a difference, by the way, between specific, dyslexia-caused reading and writing problems and the generalized learning problems that can result from being dyslexic in a nonsupportive environment.)

The way the problem is described is important; it determines societal attitudes, politics, remediation efforts, and most important of all, it influences the self-image of the dyslexic person. The use of the term "learning-disabled" has a powerful, and in this case, destructive effect; as a consequence of its use, some people are going through life believing that they have a built-in learning problem,



Compensatory Software Tools

My main word processing tools are *WordStar* (patched and reinstalled), *Word Proof*, *The Word Plus*, and *Punctuation & Style*.

Because word processing software is the part of a computer system I interact with most often, the number of features a particular program has is less important to me than the way they are designed to be used. For the dyslexic user, usability is the only consideration. An overstatement? Maybe, but consider this: Most people have to learn about the computer, the operating system, and the specific word processing program. A dyslexic person has to do all that while at the same time relearning how to read, write, and feel confident about understanding the whole thing. Whether or not a word processing program has automatic footnoting is less important to the dyslexic user than whether it's screen-oriented and its menus are easy to understand. With the above in mind, I'd recommend programs like *Word Proof* and *Volkswriter* before *Perfect Writer* and *Word Perfect*.

WordStar. My initial experimenting was with *WordStar*. I stuck with *WordStar* because I was able to use it to get work done immediately. Had I started with *Volkswriter*, I think I'd have been just as happy. After I had used *WordStar* for a few days, it fell into the background for me. I like the fact that I can completely get rid of the menus and reprogram the function keys. But I probably would have been happy with any well-designed word processing program.

Many of the people who find *WordStar* hard start by reading the abominable documentation from MicroPro. They also try to learn the most insignificant dot command before they even use the program. I'm of the "Put the disk in the drive and go, use the documentation as a reference" school.

I've taught *WordStar* to business people, doctors, lawyers, and university faculty. I've also taught it to severely dyslexic adults who had never used a typewriter before, let alone thought it was possible to write with a computer. Which group do you think learned faster? The dyslexic adults. Why? Because, in a supportive environment, they were willing and able to learn by trial and error—with lots of errors. The initial confusion didn't throw them; they moved through it in twenty minutes. It took the other groups much longer.

Word Proof. I can't get people who are impressed by quantity of features to try one of my favorite programs—*Word Proof*—because it's too simple and has very few editing features. In a feature comparison with *WordStar* or *Perfect Writer*, it doesn't fare well. But what most comparisons don't measure is the way the program is implemented.

Word Proof is easy to learn and use not only because it's simple, but also because it's well designed. It has a great menu/help system, fits on one disk, has an on-line dictionary/thesaurus that does auto-replacements, allows on-screen margin changes, and autoreforms the right margin. It makes straight ASCII files and can be used as a spelling checker for straight ASCII files made by other editors. It's very fast, it's in color (and the color is programmable), it costs $60, and it's not copy-protected.

The editor is very simple. To be useful beyond a spelling checker or beginning word processor, however, it could use a few more features. If it had block moves and block/file reading and writing, I'd drop *WordStar* in a minute for it.

The Word Plus. *The Word Plus* isn't only a spelling checker, it's a collection of writing

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when, in fact, they don't.

Tools as Extensions. Some people have a lot of hardware but haven't spent much time learning to use it. There's not enough resistance in their lives to force them to adapt—they can get through things with just the brute strength of their hardware. Other people seem to have less hardware (or damaged hardware) but have learned to use what they have in powerful ways; they've developed complex operating systems out of a need to compensate for their seeming lack of hardware power.

Glasses are an extension of our eyes. Hearing aids are an extension of our ears. Typewriters, telephones, cameras. . . .

The computer is a programmable extension of a lot of things, including, to a limited extent, our brains.

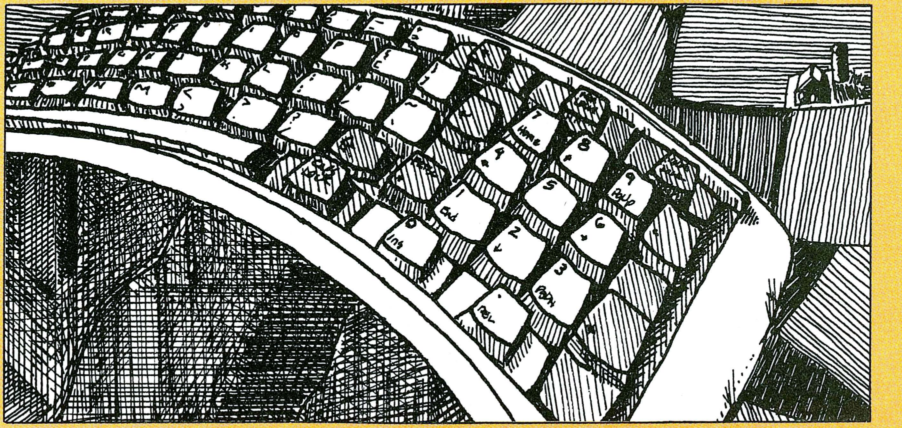
Extensions move us away from what we're using them for, and the layering is sometimes confusing. For the person who has a hard time chaining ideas, the technique of moving away from a task in order to accomplish it is hard to grasp, learn, and use.

Picture a dog trying to get through a fence. There is an open gate twenty feet to his side, but he stands there barking, frustrated because he can't get through. He may see the gate, but it's on another plane of understanding. Moving away from where he wants to go—in order to get there—is hard for him to see.

A dyslexic person learning to use a computer and word processing software is putting layers of tools between himself and his writing. The realization of how much easier it is to write with a computer (walk sideways to get through the gate) only comes after he's done it enough so that the tool fades into the background, no longer the object, but a vehicle for doing something else.

. . . including, to a limited extent, our brains.

Many tools are potentially compensatory. Tools used in this way help us compensate for a problem we have in doing something. They don't make the problem go away; they bridge it. ▲



Buffers, Brains, and Computers

Why do men mature more slowly than women?

Why are more men than women dyslexic and dysgraphic?

Why do more men than women have allergies?

Why do more men than women develop autoimmune diseases (like multiple sclerosis)?

Norman Geschwind, a neuroimmunologist at Harvard, has linked this pattern of problems to the effects of the male hormone testosterone on the brain. A small excess of testosterone present in early life (in the womb) slows brain growth and causes a developmental lag that prevents normal hemispheric specialization. Brain functions based on hemispheric specialization—sidedness and language formation—are affected.

Testosterone also influences the immune system by stunting the growth of the thymus gland, reducing the body's ability to tell its own tissue from foreign matter. This can cause the body to attack its own tissue—as happens in the autoimmune disease multiple sclerosis, in which the body destroys its own myelin (nerve insulation), which causes "shorts" that lead to the loss of muscle control and a degeneration of eyesight.

Myelin is a fatty sheath that grows over neurons to insulate them from surrounding neurons. It's a little like the insulation on electrical wire. We're born with little myelin around the undifferentiated maze of neurological pathways in our brains. As we use and reuse particular networks of pathways, they need to be distinguished from other nearby networks to prevent shorting. Myelin grows to cover networks and hardens them. The more a neural network is used, the more myelination it receives. The more diversity we're exposed to early on, the more complex and varied our networks of myelinated neurons will be. The brain develops through use.

We need to put our knowledge of the significance of myelination to better use in designing learning environments that provide a diversity of experience. Computers could be a significant part of enhanced formal education, but does the current crop of computer-aided instructional software exploit the full range of interactive possibilities the computer offers? More important, what are the assumptions of the designers of these CAI programs about the way people think and learn?

In computers, the miniaturization of chips and circuits isn't done only to bring the scale of the machines down; it's also to enable them to run faster by reducing the distance between components. In brains that have some immature neural networks because of a lack of myelination, certain cognitive processes are slower because of longer, less efficient neural pathways.

A testosterone-caused immaturity in the growth of the left side of the brain and in the associated language function prevents the use and myelination of corresponding networks of neurons. The lack of myelination in turn keeps the language process inefficient and difficult. On the positive side, the differences in learning style caused by the use of compensatory pathways to perform the same or similar functions produces diversity in the species and helps keep it flexible.

Buffers in Brains and in Computers. A buffer is a place for the temporary storage of large amounts of information. Because a microprocessor processes information serially, it uses caches and buffers to store parts of instructions until it has enough parts to execute the whole instruction. Brains have buffers for

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Compensatory Software Tools

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utilities for working with words. Included under this umbrella are spell checking with auto-replacement and a lookup feature with wildcards instead of letters. It does word counts and word frequency lists, and it works on files from *WordStar*—as well as many other word processors.

There are two features of this program that make it essential for the dyslexic writer: the automatic word correction in spell checking and the ability to look up words in the dictionary with wildcards instead of letters.

Unlike *SpellStar* and *Perfect Speller* (but like *Word Proof*), *The Word Plus* automatically writes spelling corrections into your file. It also tells you if you need to go back and reform the paragraph because the correction has made the line stick out into the margin.

I didn't know how to spell the word *naive*. Because I didn't realize it had an "a" in it, I was having trouble finding it in the dictionary. I used *The Word Plus*'s Find program by typing *find n??ve*. Two words came on the screen—*naive* and *nerve*. I recognized *naive* as the word I was looking for. I also could have typed *find n *ve*, leaving the number of letters between "n" and "v" open. There would have been more words on the screen (eighteen), but I still would have recognized *naive*. A dictionary in book form used as a spelling reference can't possibly provide this type of interactive support.

Punctuation & Style. *P & S* has two parts, Cleanup and Phrase, which are used independently of one another. Cleanup finds punctuation errors; capitalization errors; odd numbers of quotes, brackets, and toggles; numeric errors; abbreviation errors; and repeated words. Phrase finds commonly misused words and phrases and makes suggestions for revision of sentences containing them. It also finds passive voice sentences and helps turn these into active voice sentences.

A potential problem with programs that use conventions as patterns for points of comparison and don't see context is that they sculpt the individuality out of our writing—homogenize it. No one's going to shoot us (yet) if we put four spaces after a period, write everything in passive voice, or write in lists instead of sentences. There are many different ways of expressing oneself in words—thank God. But this program isn't rigid. It can be customized to fit one's personal conventions and writing style.

Other Tools. Many dyslexics are also dysgraphic. Typing helps with letterform problems but not with problems involving other symbols or freehand drawing. Programs like Logo and *Delta Drawing* and tools such as the Koala Pad are ways of exercising a broader range of symbolic expression than is possible with writing alone.

Logo is also an excellent environment in which to learn about structured thinking, building, making mistakes and debugging them, and modularity (breaking large problems into small chunks). With the use of a personal computer, a dyslexic/dysgraphic adult could spend hours with Logo without feeling humiliated for using a "kid's" program. ▲

Buffers, Brains, and Computers

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doing the same thing (although brains don't process all information serially). An understanding of how buffers are used to process language helps link the inefficient neural connections resulting from lack of myelination to the specific problems experienced by dyslexic people.

Imagine the process of reading this line. To make words out of letters, you have to see the letters in order. To make sentences out of words, you have to see the words in order. But you probably aren't reading the line letter by letter; you're combining letters into larger chunks called words and then combining those to form sentences and complete thoughts. Most people construct language so efficiently that all this happens in the background.

As you read the word *computer*, for example, you have to hold onto the C-O-M until you finish scanning to the R to make a word. This happens so fast in the brain that you're not aware of it. The place in the brain that holds onto the C, the O, and the M temporarily while waiting for the PUTER is called a buffer. We use buffers not only in reading but in processing all types of information.

Dyslexics read slowly (we think), because of the aforementioned lag in the development and myelination of the left side of their brains. Because dyslexics read slowly, sometimes giving too much attention to individual letters, they fill up their buffers before complete chunks of information can be taken in and processed.

Once full, the buffer in the brain needs to be dumped to make room for new letters. We might lose the COM in COMPUTER before we come to the PUTER. If this happens, we need to go back and scan the word again to pick up the beginning, but in so doing, we might lose the end. The same is true of the relationship between words and sentences. By the time a dyslexic reader gets to the end of a sentence, he may lose the beginning and need to go back and reread the whole thing.

It seems that there is an optimum speed for taking in sensory information, dictated by the size of a human buffer. If it's too slow, you fill the buffer (and it dumps) before you have enough information to build meaning. The buffer problem accounts for some of the bizarre ways dyslexics interpret words on a written page; sometimes we just can't see the whole word. This is the reason for using phonetic as opposed to whole-word remedial reading methods in teaching dyslexics to read. The phonetic method breaks words down into smaller chunks—phonemes—making them easier to see and remember.

Personal Operating System. Besides helping in the serial processing of language, buffers help in screening and differentiating competing incoming sensory information. I have a hard time doing more than one thing at a time (multitasking). Maybe I lack the ability to differentiate and screen background from foreground. If I get too much competing sensory information presented to me at once, I can't hold it all long enough to deal with it sequentially and sort it out.

To cope with this problem, I've developed a personal operating system—a way of working/learning—based on isolation (sensory deprivation—no distractions). This allows me to work/think at a high level of abstraction for a long enough period of time to see patterns, put handles on batches of ideas, use complex metaphors and analogies, then build larger ideas with smaller ones. As long as I'm aware of my threshold for distraction and confusion, I can get work done.

Personal computers give people power. They give the dyslexic person the power to write, to form questions and to learn in an environment that is free of human judgment. This tool sitting in front of me here has unquestionably changed my life forever. ▲

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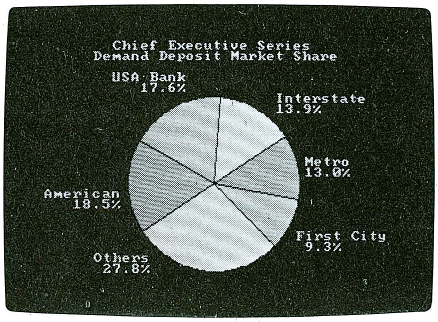

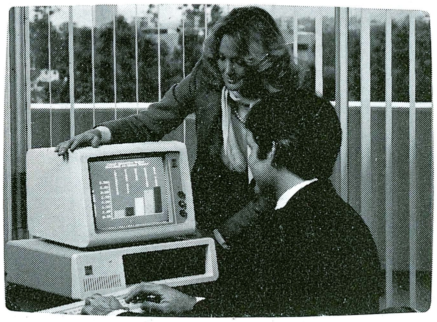

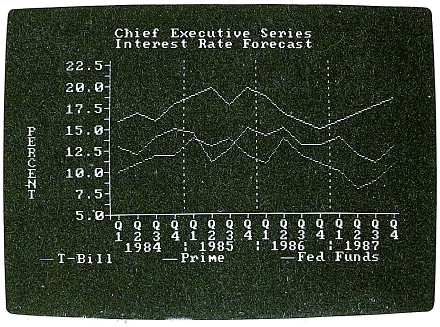

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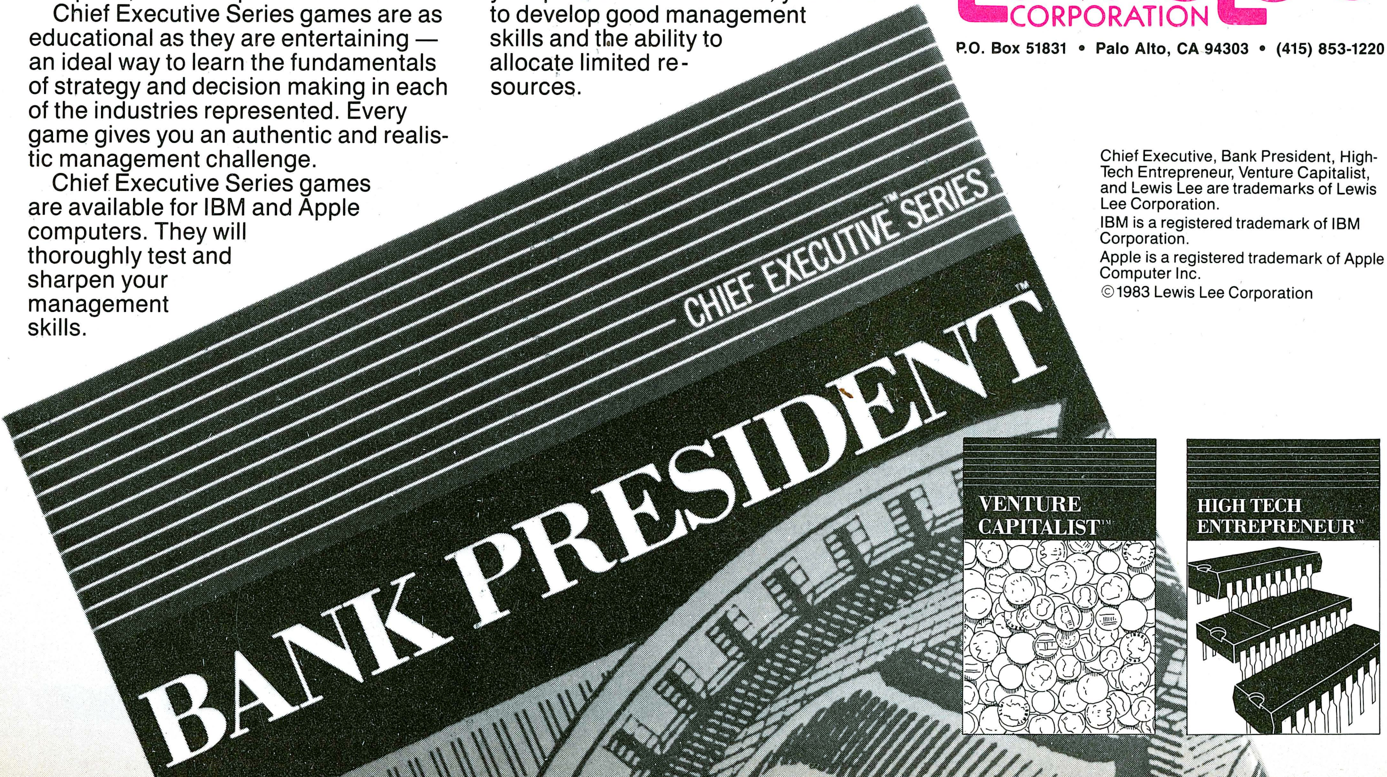

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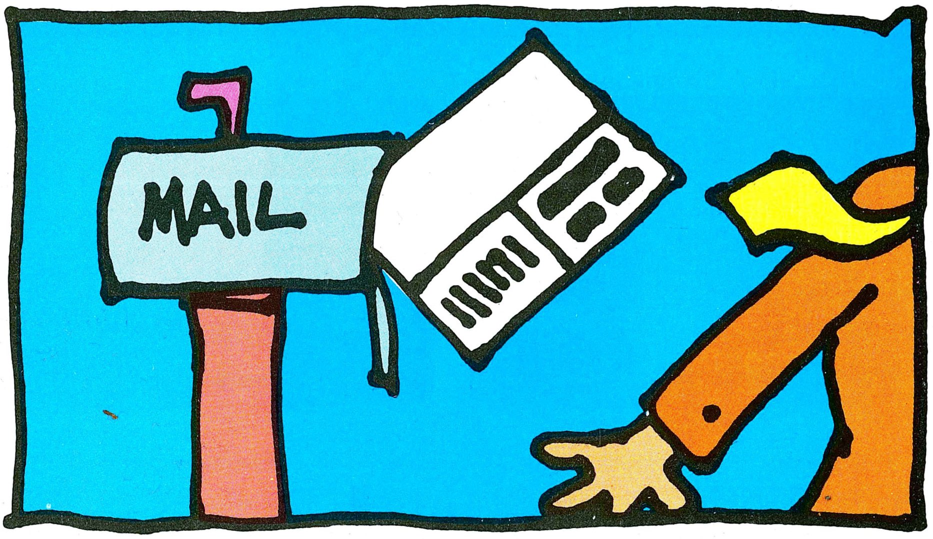

GREENE WINS PHOTON'S PC*jr*—LEAVES TOWN!!!

"I don't know why anybody bothers entering those contests to win a PC*jr*—your chances are one in a billion!" You've probably heard that lament a hundred times. Jim Greene, of Poughkeepsie, New York, probably thought that way too. Until, that is, he discovered he was the lucky winner of Photon's Unnamed, a guest contest from the March 1984 *Softalk for the IBM Personal Computer.*

As you may recall, the object of this contest was to christen a new product developed by Photon Software that provides an instant window through which you can access your printer at any time. The catchy name Jim Greene came up with?

Print Mate

Not *Print-Mate* or *PrintMate*, but *Print Mate*. Perhaps it was by bucking the trend toward MidWordCapitalization that Greene edged ahead. Reports have it (the winner is on vacation) that he is "quite elated" to have won a PC*jr* complete with disk drive, Zenith monitor, DOS 2.1, and Basic.

You're probably saying to yourself, "Sure, Jim won, but he was only one out of billions, right?" Wrong. The runners-up and special-category winners, who received copies of *Print Mate*, *Tenkey*, *Media Magician*, and a Photon binder, were legion. The first runners-up, all of whom dreamed up *Easy Print*, were Janet L. Ater (Grand Prairie, TX), C.A. Fenn (Flagstaff, AZ), Al Hammond (Atlanta, GA), Larry Stephey (Irving, TX), and Terry Rosene (Garden Grove, CA).

Second runners-up, for suggesting *Print Commander*, were Charles L. Elkins (Arlington, VA), Charles A. Coakwell III, M.D. (Mayfield Heights, OH), Mark N. Brown (Providence, RI), and J. Patrick Reinert (Webster, TX).

Third runners-up, for *Print Pro*, were Curtis Holland (Humble, TX), Charles Coakwell III, M.D., Jack Miller (New Milford, CT), Wendy Jo Martin (Havana, IL), and Larry Stephey.

The most humorous entry came from Diana Chepurko (Houston, TX), who penned the lighthearted appellation *Sweet Add-A-Line*. The best acronym, from Raleigh, North Carolina, was J.A. Wooten's *O.P.E.N.*, which stands for Online Printer ENvironment. And the dubious distinction of the worst name (for Photon's product, that is) goes to Troy Conner for *Fontwacker.*

"Gee, I didn't realize it was so easy to win. I could have thought up names as good as those!" Right. And the next time *Softalk* hosts a guest contest, you'll get your big chance.

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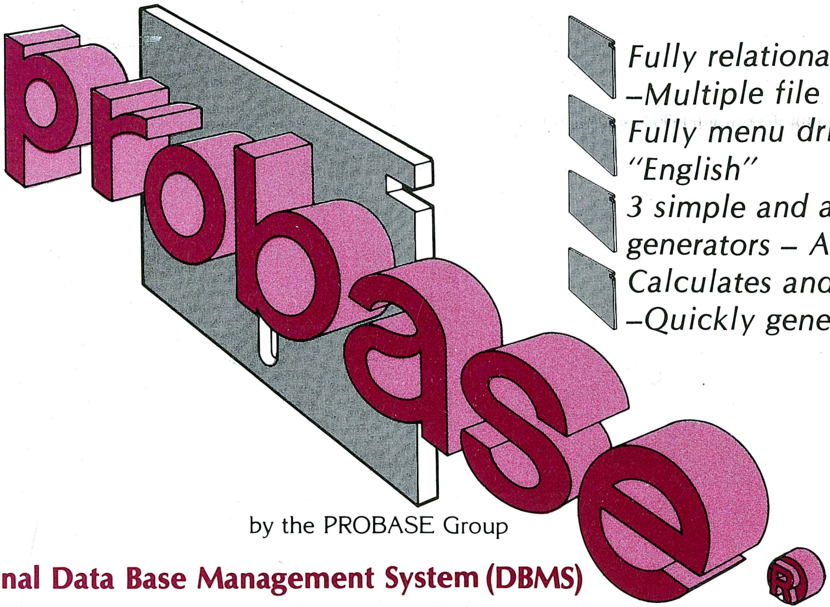

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THE C SPOT

by Rex Jaeschke

Introduction to Pointers

As promised last month, we are about to begin an exciting journey through the perilous pits of pointerland. The capabilities we've covered up to now have been slight variations on things that are already available in other languages. Pointers, however, are a new concept.

Pointers are powerful and easy to use; but if used carelessly they can make code unreadable, unmaintainable, and difficult to port to other systems. In short, pointers can provide a lot of capability and a lot of trouble. Probably the best way really to understand pointers is to use them—again and again and again.

A pointer is a variable that contains the address of another variable. If a pointer to a variable is known, the contents of that variable can be accessed through that pointer. For example,

```
/* point1.c - Introduce pointers */
main ()
{
        int var,*pvar,newvar;
        float fvar,*pfvar,newfvar;
        var = 10;
        printf ("Value of var is %d\n",var);
        pvar = &var;
        printf ("Address of var is %u\n",pvar);
        newvar = *pvar;
        printf ("Value of newvar is %d\n",newvar);
        fvar = 123.234;
        printf ("Value of fvar is %7.3f\n",fvar);
        pfvar = &fvar;
        printf ("Address of fvar is %u\n",pfvar);
        newfvar = *pfvar;
        printf ("Value of newfvar is %7.3f\n",newfvar);
}
```

produces the output

```
Value of var is 10
Address of var is 65506
Value of newvar is 10
Value of fvar is 123.234
Address of fvar is 65498
Value of newfvar is 123.234
```

*int *pvar;* defines *pvar* to be a pointer to an integer. That is, *pvar* contains the address of the integer variable it points to. In this context, the * is a unary operator and should not be confused with the multiplication binary operator that uses the same symbol. Similarly, *float *pfvar;* defines *pfvar* to be a pointer to a float value.

Once a pointer has been defined, it can point only to objects of the specified type. Attempting to make *pvar* point to a double, for example, will cause a compilation error.

The size of a pointer is compiler-dependent. On the PC and other sixteen-bit systems, most C compilers use sixteen-bit pointers that can point to a maximum of 64K locations. That's why these compilers create programs with a maximum of 64K of data space; they can't directly access more memory locations. Some compilers use thirty-two-bit pointers; this allows for very large programs and data areas.

The & unary operator means "Take the address of my operand." Hence *pvar = &var;* assigns the address of *var* to *pvar* (in this case to 65506). That is, *pvar* points to *var*. Note that we don't write **pvar =*

Come in late on "The C Spot"? All back issues of the column—from January 1984—are still available; for further information, see page 4.

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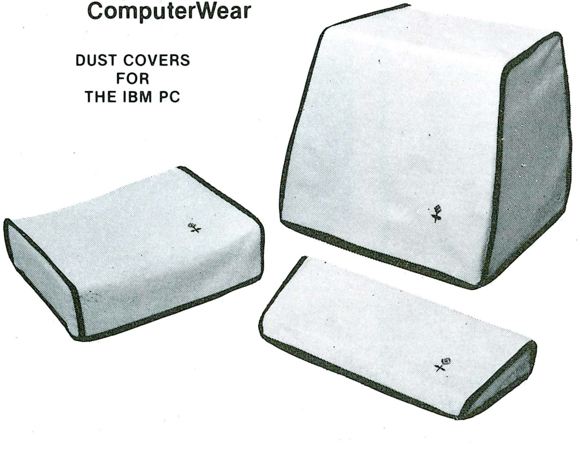

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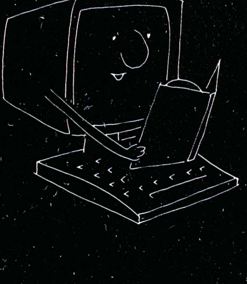

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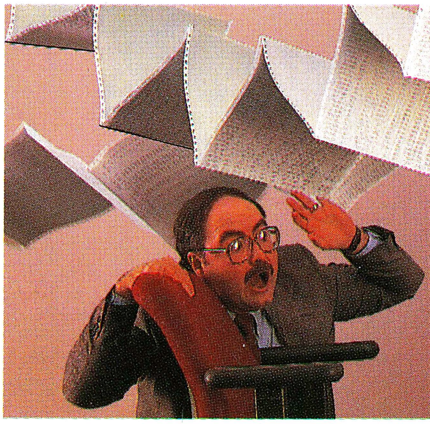

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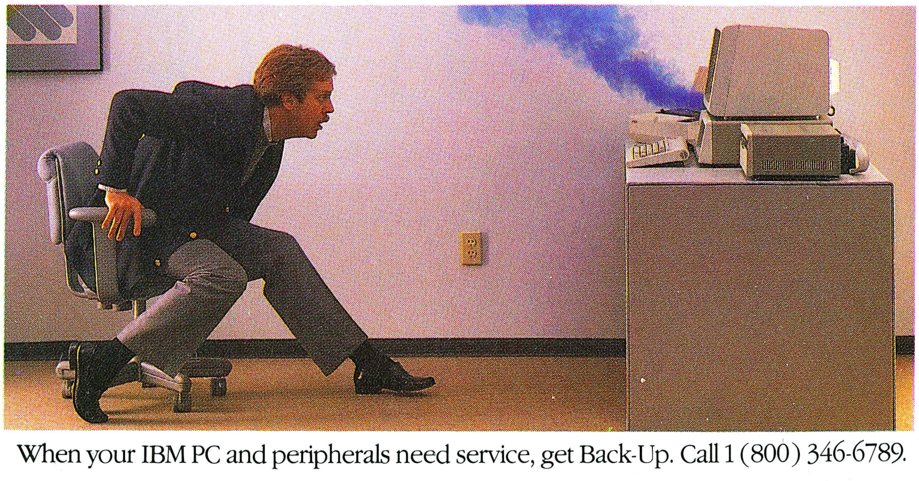

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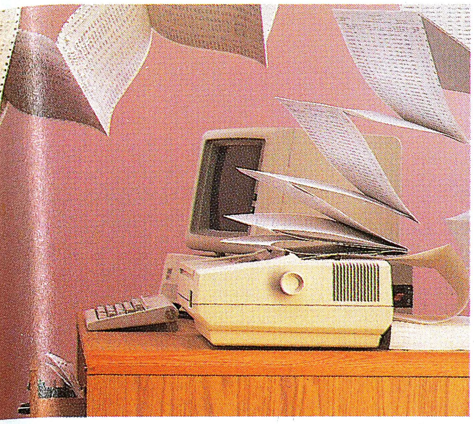

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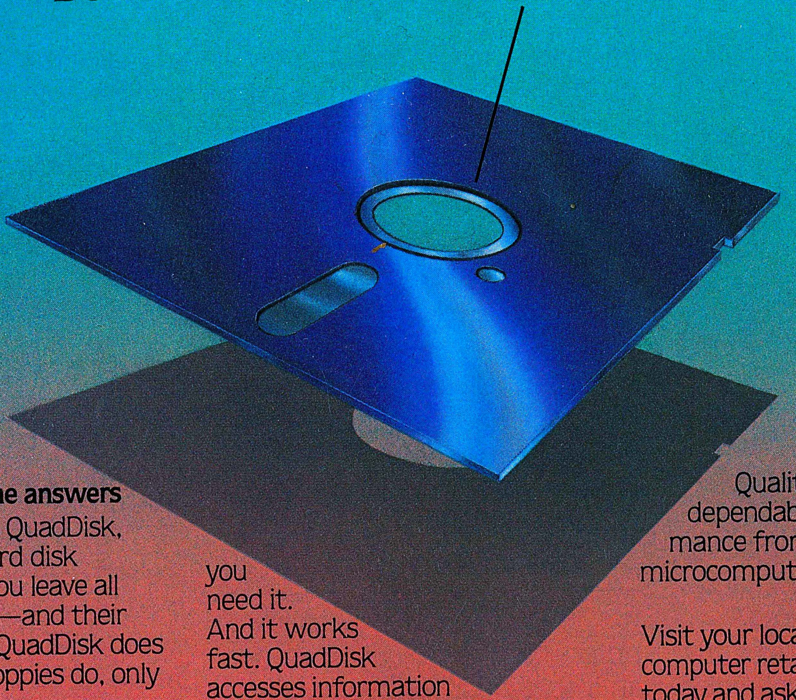
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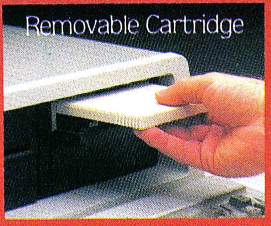

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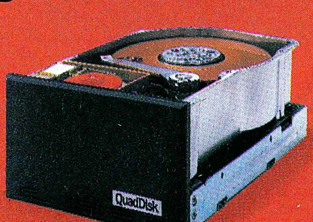

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&var;. When we assign an address to a pointer, as in this case, the * must not be used.

By definition, pointers must point to real memory locations. Therefore they must contain values in the range of 0 to the maximum positive pointer value; they can't contain a negative value. Since pointers are unsigned quantities, they must be printed using the unsigned edit mask *%u*, as the *printf* example shows. Don't confuse the unary operator *&* with the binary bitwise AND operator, which uses the same symbol.

The unary operator *&* cannot be used with register variables, because the hardware registers don't have memory addresses. The address of a register variable can't be found, even if that variable isn't stored in a register. Likewise, the address of a literal string, such as "Hello", can't be determined. Expressions such as *&"onetwo"* are illegal; so is *&(expression)*, because an expression is not a variable.

*newvar = *pvar;* assigns the contents of the address pointed to by *pvar* to *newvar*. That is, it takes the *int* value stored at location 65506 and copies it to the variable *newvar*. In this case we must use the * operator. *newvar = pvar;* makes *newvar* point to the same address that *pvar* points to. Since *newvar* wasn't defined as a pointer to begin with, this doesn't make sense, although it probably will be allowed by the compiler. In this case, the *int* variable *newvar* would be assigned the address value that *pvar* points to. This kind of statement is dangerous because *newvar* is a signed *int* while *pvar* is an unsigned value. Strictly speaking, *newvar* doesn't contain an address, but rather a signed integer value. Pointers *should never* be thought of as integers and should never be assigned to *int* variables.

pvar means "pointer to some object," while **pvar* means "the actual object being pointed to." In the example *point1.c*, **pvar* is actually equivalent to an *int* variable and, as such, can be used in any expression in place of a "regular" *int* value. For instance, *newvar = (*pvar + 27) / 12;* is a perfectly valid statement.

In a roundabout way, this statement achieves the same result as the statement *newvar=var;*, except that it uses a pointer. As mentioned earlier, if a pointer to a variable is known, the contents of that variable can be accessed through that pointer. In this case, we can get at *var* through the pointer *pvar*.

The example uses *fvar* and *pfvar* to demonstrate the same principles for variable types other than *int*. Pointers can point to objects of any of the data types.

As pointers are variables, and pointers point to variables, pointers can point to other pointers. A pointer that points to a pointer, which in turn points to a variable, just adds another degree of indirectness. This kind of operation will be familiar to the seasoned assembly language programmer.

The *printf* edit mask *%7.3f* displays the float or double argument using seven character positions (minimum) with three decimal places. This is similar to the *Fm.n* syntax used in FORTRAN's *format* statement, except that *%7.3f* displays *at least* seven positions (it uses more if necessary); in FORTRAN, *m* is both the maximum and the minimum field width.

If you are totally confused, you're not alone. Coming to grips with pointer basics takes time and usually requires *n* readings of the explanation, where *n* may be a large number. Don't go any further until you're comfortable with the material presented so far. Above all, do not despair. Read and reread the text, then write some simple programs of your own.

Incrementing and Decrementing Pointers. Like variables, pointers can be incremented and decremented. For example,

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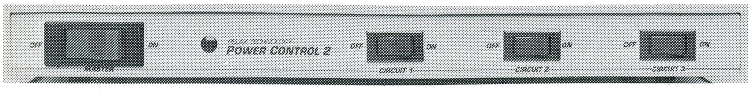

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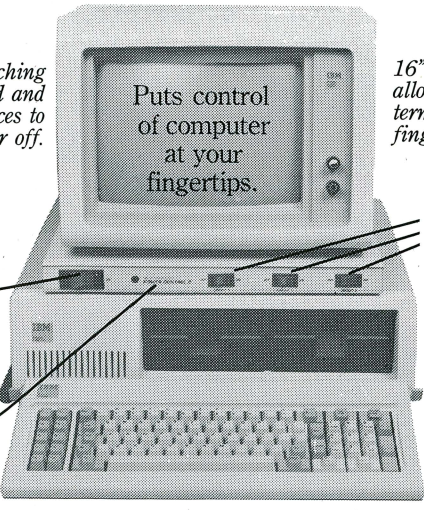
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```
/* point2.c - pointers and char arrays */
char name[] = "JOHN SMITH";
main ()
{
        char *pc;           /* define pointer to char */
        pc = name;          /* point to start of name */
        while (*pc)         /* test if end of string found */
                putchar (*pc++); /* if not, display char */
        putchar ('\n');
}
```

produces

```
JOHN SMITH
```

This example defines the array _name_ as a global (or external) by placing its definition outside of any function. This makes the example simpler, as external arrays can be initialized at definition time, whereas automatic arrays cannot. The compiler will determine the correct dimension of the array by counting the number of characters in the quoted string and adding 1 for the _0_ terminator. _name_ is eleven characters long.

_pc_ is defined to be a pointer to a _char_. _pc = name;_ causes _pc_ to point to the same address that _name_ points to; that is, the address contained in the pointer _name_ is copied to the pointer _pc_.

Straightforward enough, but what's this pointer "_name_"?

Ever since we introduced arrays in this series, we have been using pointers without saying so. The name of an array is really a pointer that contains the address of the first element in that array. This should be obvious when you consider that we saw that array arguments in function calls are passed by address, not by value. _name_ then is synonymous with _&name[0]_. We could have written _pc = &name[0];_ instead of _pc = name;_.

while (*pc) tests the value of the _char_ pointed to by _pc_—in this case, the letter _J_. _J_ has a nonzero value (74) that tests true, so the body of the loop is executed. _putchar (*pc++);_ causes the _char_ pointed to by _pc_ to be printed. Then the pointer is incremented so that it points to the next _char_ in the name array. This process is repeated until the terminating null character is reached, whereupon the _while_ test proves false, the loop is terminated, and the _newline_ is printed.

As you know, the ++ operator increments its operand by 1. In this example, it increments the pointer _pc_, making it point to the next _char_ in the array. The programmer may not know (and shouldn't care) how many bits, bytes, or words the pointer really has been incremented by. All that matters is that the incrementing of a _char_ pointer gets you to the next _char_ in the string.

Note that we rely on the presence of the terminating null. If that character were not there, we would march right off the end of the string into no man's land. C provides no runtime checking to ensure that an array pointer indeed points to an element in the array.

The expression _*pc++_ is worthy of comment. Since the unary operators * and ++ are evaluated left to right, _*pc_ is evaluated, its value is used, and then the pointer _pc_ is incremented by _pc++_.

As we have seen, _*pc_ is equivalent to a _char_ variable. So far we have used _*pc_ to take the value of the _char_ pointed to by _pc_. We have seen the expression _*pc_ only in the right-hand side of an assignment expression. It also can be used on the left side. For example, _*pc = 'X';_ means set the value of the _char_ pointed to by _pc_ to 'X'.

Now, back to the whole expression _*pc++_. The order of evaluation implies that _*pc++_ might be equivalent to _(*pc)++_. This is _not_ the case. _(*pc)++_ causes the _char_ value pointed to by _pc_ to be incremented by 1. The actual _char_ pointer _pc_ is not changed. Isn't C fun?

Next month we'll continue on the perilous pointer path. In the meantime, thanks to readers who have written with questions, comments, and suggestions; keep those letters coming. ▲

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The ever-understanding Luba Goy guides Billy Van through a tutorial on Bits and Bytes, *a presentation of TVOntario. The series provides an introduction to computers, as well as segments on languages, graphics, communications, and other computer-related topics. The twelve half-hour programs are being broadcast on PBS stations throughout the U.S.*

COMPUTER LITERACY:

LUBA GOY AND BILL VAN SHOW THE FOLKS IN TV LAND

BY JOANN LEVY

With a name like Luba Goy, she almost has to be good. And she is: understanding, confident, knowledgeable, reassuring. Even her office and desktop look just right—neat and professional, with a nice photo of her children handsomely framed. Billy Van probably needs all that. You can tell he'd be a bit of a bumbler if it weren't for Luba. Oh, he's agreeable as all get out, but a trifle perplexed.

For twelve weekly half hours these two get together. Luba, attractive, businesslike, carefully groomed, is invariably patient but firm. Billy, his middle-aged boyishness beaming through owlish glasses, bounces good-naturedly between confusion and amazement. The duo could be analyst and patient or sitcom costars. In fact, they're Canadian actors portraying teacher and student in TVOntario's computer education series, *Bits and Bytes*.

Hats off to the Canadians for reversing the typical assumptions; in this case it's the woman who knows everything there is to know about computers and the man who has to be told where the switch is. The role reversal should be reassuring for computer-illiterate men, perhaps already on shaky ground, who now, thanks to silicon chips, have a whole new reason to feel inadequate. Everyone can take heart from Billy Van. He can't type—but he can learn to use a computer.

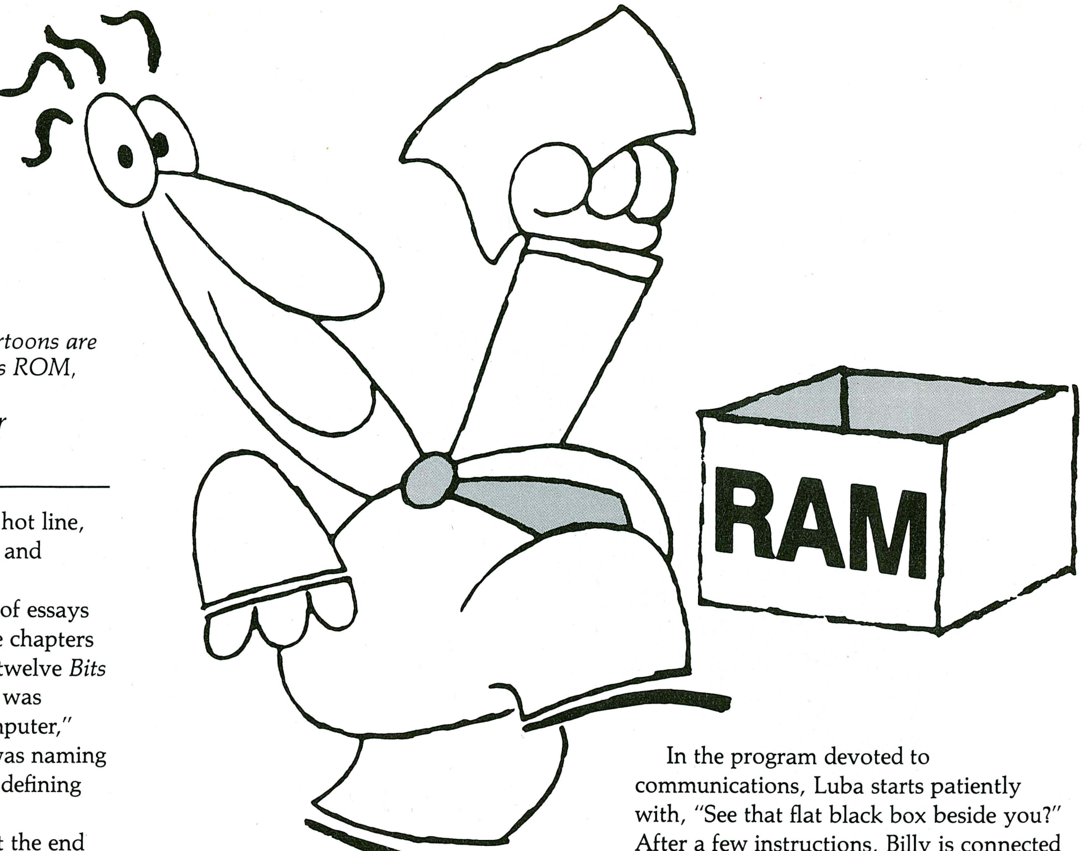
That's what the series is all about: demystifying the technology, parading the computer's myriad capabilities, and demonstrating that *anyone*—even guys like Billy Van—can find them fun and useful.

Bits and Bytes was enormously successful when it first aired in Ontario last spring. More than ten thousand people from the Toronto area alone enrolled. The program's appeal is as broad as its potential audience, since it was designed for all ages and for anyone who wants to learn about computers.

When the series was aired for U.S. viewers in January, as part of a Public Broadcasting Service program called *Academy on Computers*, it marked the first time that television here has been combined with hands-on computer learning experience. Participating were four PBS stations in New York, two in California, plus one each in Kentucky, Nebraska, Ohio, and Wisconsin. Community newspapers published the program announcement along with an enrollment coupon. Viewers interested in total participation paid seventy dollars for the privilege.

Nationwide, more than thirteen thousand people paid up. Of those enrolled, 27 percent specified the IBM PC as the computer used to work through the course. More than three thousand folks in Los Angeles popped for the fee, thereby committing themselves to KCET each Saturday at noon (or reruns Sunday morning at 9) for twelve consecutive weeks. Program schedulers at KCET really know how to bust up a weekend. Of the other participating PBS stations, Toledo's WGTE offered the most accommodating schedule, with three weekday airings, plus Saturday and Sunday.

Of course, anyone with a television set and a paid-up electric bill could have watched Luba and Billy for free. Official registrants, however, received, for their seventy dollars, a 175-page large-format *Resource Book*, a 40-page *Hands-On Beginner's Manual* and floppy disk specific to the registrant's computer, a series of newsletters, a pamphlet describing



In addition to Luba and Billy, cartoons are used to illustrate concepts such as ROM, RAM, and CPU. There are also interviews and visits to computer hot spots like Silicon Valley.

educational software, access to a hot line, plus two tests with answer sheets and postage-paid envelopes.

The *Resource Book* is a series of essays and articles organized into twelve chapters and designed to complement the twelve *Bits and Bytes* programs. While Luba was saying, "Hello, Billy, this is a computer," chapter 1 of the *Resource Book* was naming the computer's component parts, defining bit and byte, and describing how information is stored on disks. At the end of chapter 1, the truly committed are invited to consider such questions as, "Do you think there are computers that are never turned off? What uses would you see for such computers in the home? In the school?" Then, to top off the lesson, there is a self-test (answers in the back of the book).

Subjects covered during the twelve weeks include getting started, communication between computers, computer languages, computer-assisted instruction, simulations, graphics, computer music, and more. After the sixth program/chapter, participants are supposed to test their understanding up to that point with a multiple-choice exam consisting of thirty questions. You transfer your answers to a separate sheet and mail it in the provided envelope; two weeks later you receive a printout telling you why your answers were correct or incorrect. Those who go the whole nine yards and send in the second exam after the twelfth lesson receive a certificate of completion for the course.

For the unskilled or intimidated, *Bits and Bytes* should be wonderfully reassuring.

The *Hands-On IBM PC Beginner's Manual* is essentially basic and Basic. The keyboard is explained in Unit I, and how to use ready-made programs in Unit II. Unit III, entitled "Programming—Who Me?," introduces the remaining chapters on programming in Basic. The software is designed to walk you through the concepts and includes self-tests.

The newsletters are a mix of brief articles, questions and answers, and reminders to mail your questionnaires and use the "Academy" hot line if you have difficulties. And there really are people there to help out. It's one of the components of the program that are truly interactive.

The pamphlet on choosing educational software is invaluable to educators. It includes an extensive list of organizations that provide critical reviews of educational software as well as an educational software evaluation form for comparison rating of programs.

Of course, the best part of the whole *Academy on Computers* package is *Bits and Bytes*. Each week Luba carefully explains some new concept to Billy, who cheerfully tries it out—everything from programming to playing games to using a modem to creating computer graphics and music.

In the program devoted to communications, Luba starts patiently with, "See that flat black box beside you?" After a few instructions, Billy is connected to an electronic bulletin board and with his usual gee-whiz attitude says, "And this is all coming from Willowdale, New York?"

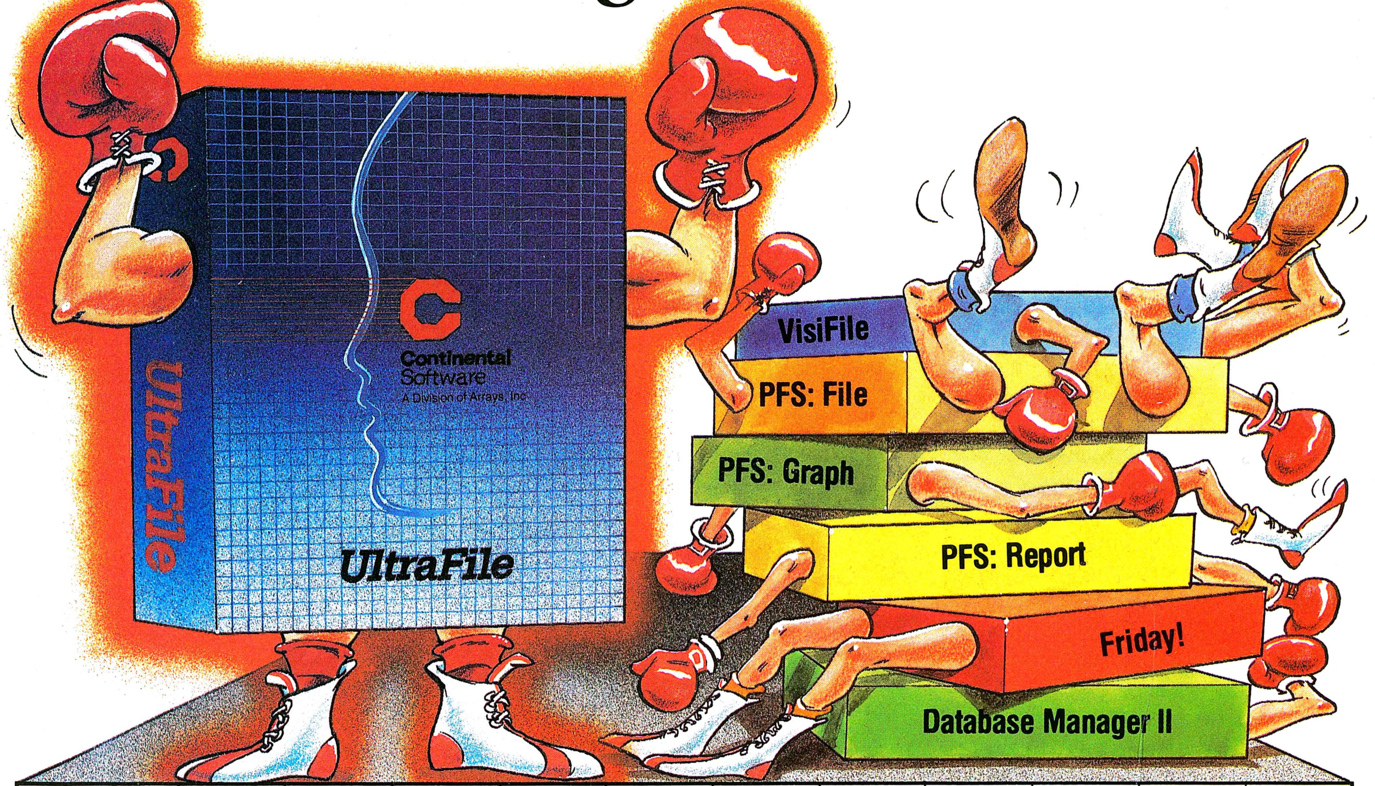
Billy's almost unvarying response to Luba's directions is "Okey-dokey," a folksy, comfortable reaction designed to show viewers that computers are anything but scary. They're fascinating, fun, amazing, useful, and capable of performing more tricks than a dog-and-pony show.

For the unskilled or intimidated, *Bits and Bytes* should be wonderfully reassuring. It's also unusually entertaining. The folks at TVOntario have gone to great lengths to make the series interesting and informative.

Supplementing the two performers are clever and entertaining cartoons designed to simplify such concepts as ROM, RAM, and CPU operation. There are demonstrations, visits to computer hot spots like Silicon Valley, and interviews to further break up the programs into a surprisingly fast-moving thirty minutes.

One segment includes interviews at a ComputerTown, showing people from eight to eighty learning, experimenting, and enjoying the process. (ComputerTowns, an informal public-access computer-literacy project begun in Menlo Park, California, in

UltraFile™-vs- The rest of the database/file management world.



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Thirdly, UltraFile has automatic data formatting. So if you want a certain word in your text to appear in all caps, you only have to enter it that way the first time. UltraFile automatically capitalizes the word each time it appears. That means fewer errors and more consistency in your text.

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The team of David Stansfield and Denise Boiteau are producing Bits and Bytes.

1979, are in approximately seventy locations in the U.S. and abroad.) Another program has musicians explaining how musical frequencies are created and music is composed at the computer. Some computers are designed to mimic instruments. The Commodore 64, for instance, can turn its keyboard into that of a piano. The IBM PC was apparently designed with loftier intentions.

An artist interviewed for the program on graphics demonstrates some remarkable creations. At the same time, viewers learn all about low-resolution character generation, high-resolution bit mapping, and that the word *pixel* comes from "picture element."

There's no question but that the series makes computers attractive to even the most die-hard pencil-and-paper devotees. It succeeds admirably in stripping the mystique and revealing the computer as, according to one enamored artist, "a dream machine." This should be an enormously reassuring program for those who bought computers only to discover that all they have in common with TVs, stereos, VCRs, and assorted other electronics around the house is that they plug into standard outlets. An astonishing number of computer purchasers apparently saw, bought, and failed to conquer. According to a survey done for *InfoWorld*, an astounding 25 percent of all personal computer owners have either stopped using them or never started—including 13 percent of IBM PC owners!

People who can take such an "ouch" to the pocketbook may well want to pop for another seventy dollars to help ease the apparent frustration. The familiar glow of the old boob tube may be just the answer. Encouraging programs such as *Bits and Bytes*, especially interactive ones complete with study materials, may be just what's needed to get the machine out of the closet and get the frustrated owner to try again.

PBS nationwide is airing several television series about computers. *Bits, Bytes and Buzzwords*, a five-part series of half-hour programs, is a no-nonsense introduction to word processing and other business and educational uses. *Computers at Work: Concepts and Applications* is fifteen half hours designed to aid viewers' understanding of computer-based systems and their applications.

The Computer Programme, a BBC production, in ten half-hour programs, presents the basic concepts of computers and their applications, each with a theme illustrated by examples of computers at work in the real world. *Making the Micro*, another BBC production and a sequel to *The Computer Programme*, is ten half-hour programs designed to teach viewers how to use a microcomputer.

The New Literacy: An Introduction to Computers is a set of twenty-six half-hour programs providing a comprehensive overview of electronic data processing, computer hardware and software systems, and developments in the further advancements of information processing. *Making It Count*, produced by Boeing Computer Services, consists of twenty-three half-hour programs about hardware, software, programming, and data processing.

Educators may be particularly interested in these programs, and so should those folks with PCs now serving as plant stands. Call your local public television station to find out if and when any of these programs are scheduled for viewing in your area.

Now all we need is a series on some of the nitty-gritty stuff—like why your modem cable doesn't work; why, despite fifteen tries and instructions followed to a T, you get an error message instead of a printout; and what to do when the manufacturers of your peripherals go belly-up. The answers to those problems probably just aren't suited to prime time. ▲

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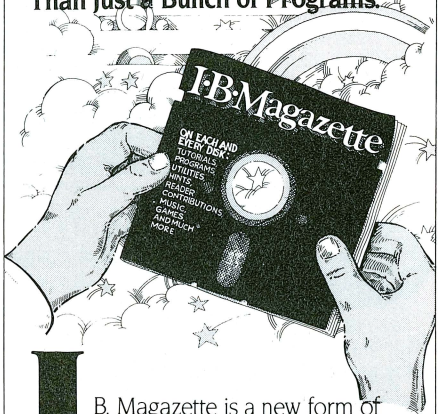

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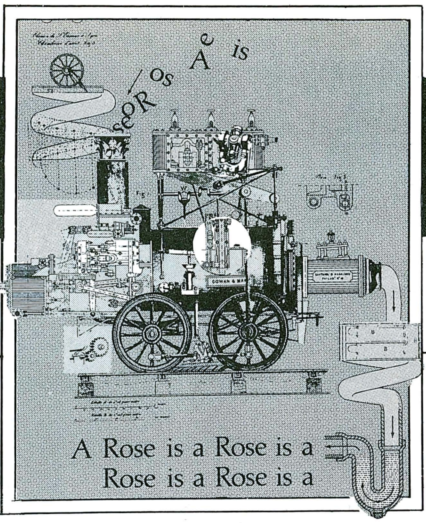
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Rose is a Rose is a

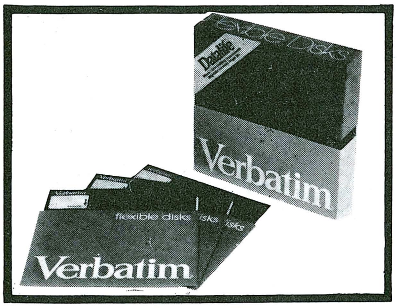
by Terry Tinsley Datz and F. Lloyd Datz

Volkswriter Gets a Tune-up, *Palantir* an Update

Just like its four-wheeled namesake, *Volkswriter* is a classic. Reliable, easy to learn, and inexpensive, it rolled off the assembly line just in time to provide an alternative to the fickle *EasyWriter 1* and the forbidding *WordStar*. Since then, plenty of other word processors have entered the race, each sporting more exotic features than the last. But all the while *Volkswriter* has kept chugging along.

Now, with all those miles behind it, *Volkswriter* has finally gotten a well-deserved tune-up in the form of *Volkswriter Deluxe*. That doesn't mean, however, that the original *Volkswriter* is headed for the junkyard; it's still available for those who want to travel economy class.

Verbatim Diskettes



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If you're a *Volkswriter* fan, you'll be happy to learn that *Deluxe* is cast from the same mold. It shares its predecessor's uncluttered screens and many of the same key assignments. Also passed on intact is the gentle style that comes back with "Beg your pardon" when you've done something uncomputable.

Overall Design. How does *Deluxe* outperform the old-model *Volkswriter*? For starters, it's more generous in terms of file size, which it restricts not to the amount of RAM you have but to the amount of space you have on disk. It does on-screen formatting, showing you such things as page breaks and special printing effects (underscoring and boldfacing). Among the other new features are a special mode for moving columns, horizontal scrolling capability (to two hundred fifty columns), and additional cursor controls. Also new is a notepad file that's handy for jotting down phone messages or bright ideas that occur to you while editing. And, last but not least, *Deluxe* has a feature called TextMerge, which provides a simple way to deal with form letters and mailing labels.

The last item on *Deluxe*'s main menu, H for Help, brings up a description of each of the other eleven options. Although you have to return to the main menu for a few tasks—to display the file directory, to rename or delete a file, or to use TextMerge—you can change formats, print, and save your work from within the editor via the function keys.

The function keys work overtime with *Deluxe*; the program uses them—in finger-twisting combos with control, alt, and shift—for everything except a few embedded commands that control formatting and merging. Since it takes a while to get a handle on which combinations do what, *Deluxe* provides an optional help menu, a seven-line summary of all possible function-key combinations. Hit F1 and the help menu pops up at the top of the editing screen; hit F1 again and it goes away. You'll also find yourself reaching for F10, the panic button, which cancels the command in progress, just as it does in *Volkswriter*.

Text Entry and Editing. The text-entry screen is clear except for a single inverse-video line at the bottom. Here *Deluxe* displays the name of the file you're editing, the cursor's position (column, line, and page number), and messages and prompts. *Volkswriter* users will notice that the "gas gauge," which shows you the percentage of memory available, is missing—and for good reason: With *Deluxe*, you don't have to quit editing when you run out of memory.

Deluxe provides a nice assortment of cursor moves. The arrow keys speed the cursor along by character and line; when combined with the control key, they take you backward and forward by word. Unlike most other word processors, *Deluxe* has no qualms about letting you move the cursor past the end of a line into no-text land. In fact, if you get carried away with the right-arrow key, you can travel all the way out to column 250, which is *Deluxe*'s limit for horizontal scrolling.

For long-distance cursor moves, you use the home key, either by itself or in combination with other cursor keys. For example, by hitting home followed by the left or right arrow, you can jump to the first or last character on the current line. Similarly, home plus the up or down arrow takes you to the top or bottom of the screen, leaving the cursor's horizontal position unchanged. Home also performs on its own: Two presses takes you to the top left corner of the screen; three presses puts you back at the beginning of your file. The end key works much the same way as home, but in the opposite direction.

With the page-up and page-down keys, you can scroll vertically by half screenfuls, or by whole screenfuls if you tap home first. What's new is that, by combining these keys with the control key, you can scroll through your file a page at a time, stopping at the top of each page.

That's not all. The function keys also get into the cursor act. F3 toggles you between the

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beginning and end of the current line (a quick return ticket when you've scrolled beyond eighty columns), and control-F7 takes you directly to any page or line in your document.

Deluxe's default mode for text entry is overtype, which means that new text automatically replaces everything in the cursor's path. As you'd expect, you hit the insert key to get into insert mode. *Deluxe* lets you know you've switched modes by changing the cursor from an underscore to a square. To make room for your addition, it pushes existing text ahead one line. When you've finished inserting, you hit F1 again to go back to overtype mode. There's no way to stay in insert mode; *Deluxe* has the rude habit of kicking you back into overtype mode the second you enter another editing command or when you get to the end of the paragraph—whichever comes first.

Deluxe gives you several options for deleting. The backspace key deletes to the left of the cursor, and the delete key erases what's under the cursor. Holding the delete key pulls in characters from the right—but only until there are no more characters on the line; text on the line below stays where it is.

Larger deletions involve the use of the F4 key. By itself, F4 deletes the word at the cursor position, along with any trailing spaces. When the cursor sits within a word, F4 deletes only the characters to the right of the cursor. Combined with alt and control, F4 works on lines: Control-F4 deletes the entire line and alt-F4 erases from the cursor to the end of the line. There's no restore command, however; if you wipe out a whole line when you intended to erase only a couple of words (something that's easy to do), you're out of luck.

Unfortunately, *Deluxe* bucks the trend of other new word processors by not providing automatic paragraph reform. If an insertion or deletion leaves your paragraph ragged, you have to reform manually by hitting F8. Everything from the cursor position to the end of the paragraph shuffles into place in the tradition of *WordStar*'s control-B, but it does so a little more slowly.

Deluxe has two modes for block operations, one for regular text and one for columns. The column mode is entirely new, and the text mode has been improved to work with partial lines (the original *Volkswriter* limits cut-and-paste operations to whole lines of text). No matter which mode you're using, you start by marking the block's beginning and end. For regular text, you put the cursor over the first character in the block and press F5; then you move to the last character and hit F6. *Deluxe* inserts bright triangles as markers. If you're working with columns, you mark the upper left and lower right corners using control-F5 and control-F6. In column mode, *Deluxe* inserts arrows as markers.

Once you've done the defining, *Deluxe* handles blocks the same way—whether you're working with normal text or columns. To delete the entire block, just hit alt-F8; to copy or move it, position the cursor at the new location and press alt-F5 or alt-F6. Once the mission has been accomplished, *Deluxe* whisks the markers off the screen, causing the copied or moved block to fade into the surrounding text. Not only does this make it hard to tell if everything went as planned, but, if you decide to put everything back the way it was, you have to reinsert the block markers.

When it comes to search and replace, *Deluxe* unfortunately offers no improvement over *Volkswriter*; it's still literal to a fault. You can't search for capitalized and uncapitalized occurrences of a word at the same time, nor can you ask that only whole words be located. To find all occurrences of a word, capitalized or not, you either have to do two separate searches or else enter the word with the first letter missing. The same limitations apply to the replace feature, which means that, when doing global replacements, you can't match the case of each replacement word.

Although *Deluxe* won't search backward, it compensates by starting its search at the cursor position, working its way to the end of the file and then looping back to the beginning to cover text that's behind the cursor. Only when

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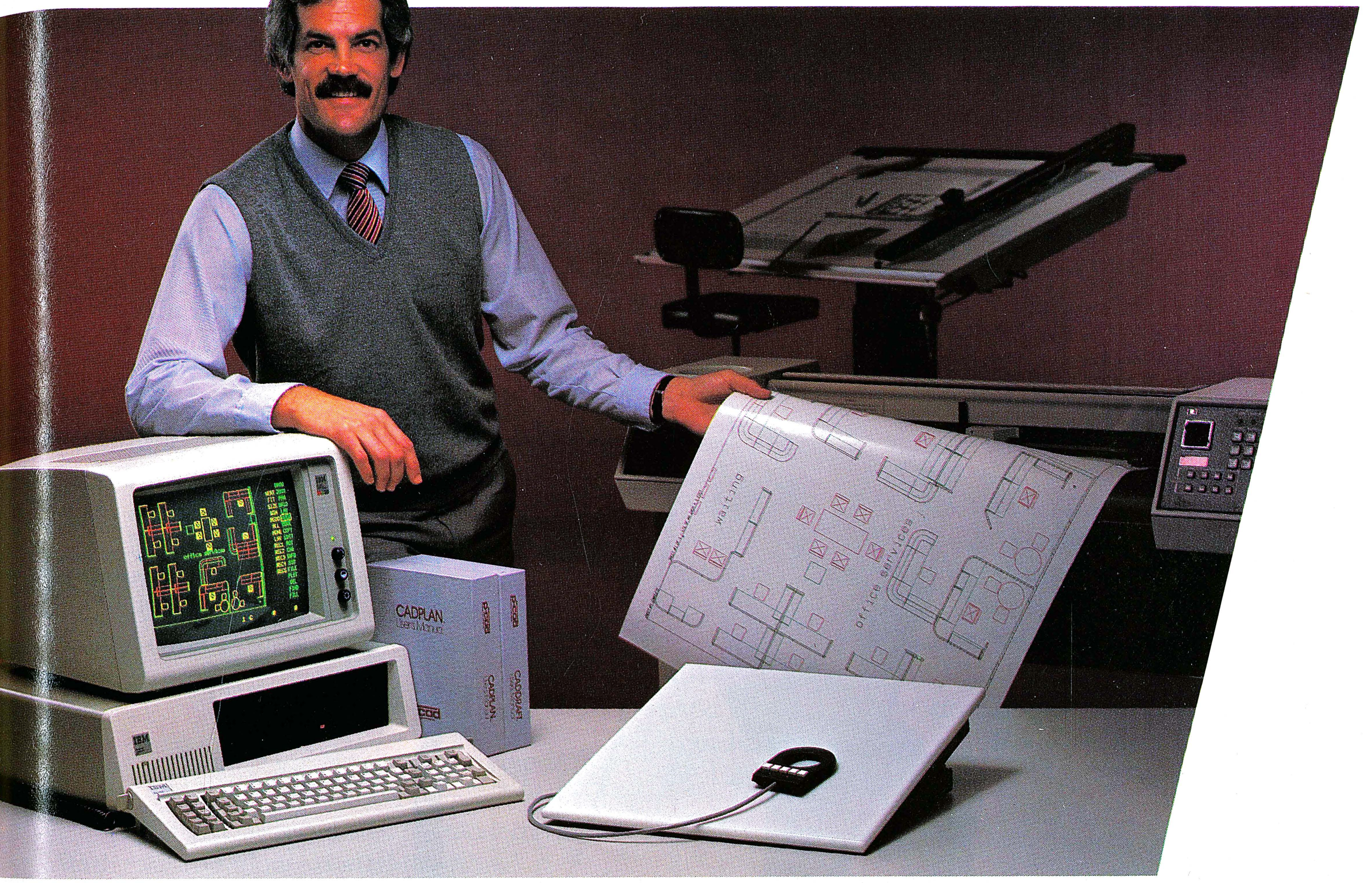

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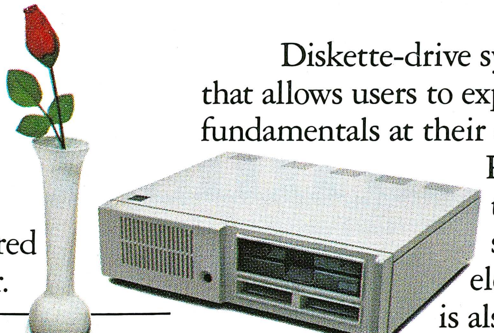

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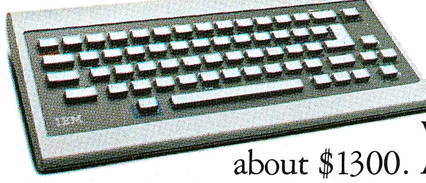

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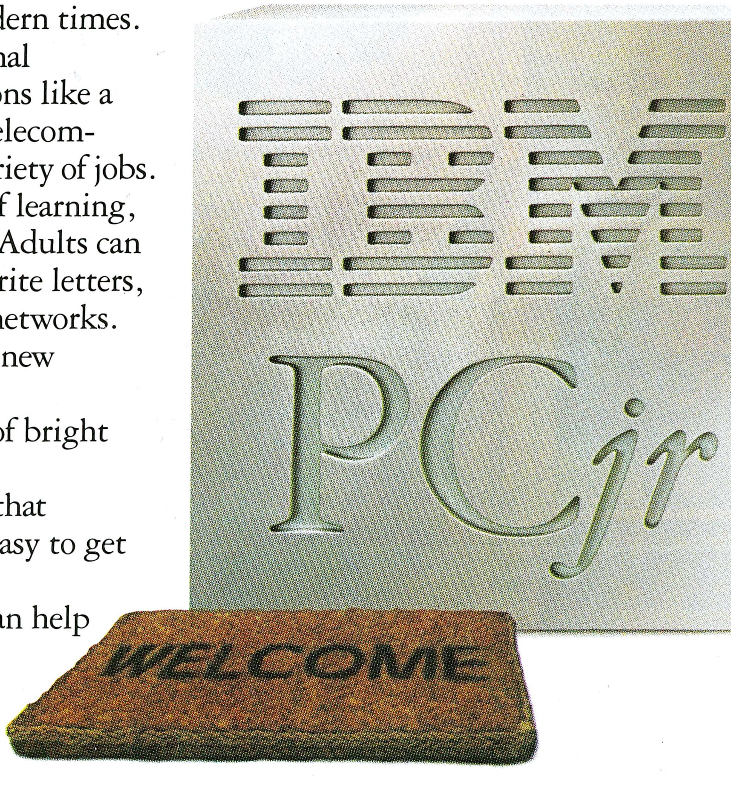

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you ask for a global replacement does it start at the beginning of your file and proceed straight through to the end.

Formatting and Printing. The good news about *Deluxe*'s formatting capability is that what you see on-screen comes close to matching the final printed version. Unlike *Volkswriter*, for example, which gives you no clue as to where page breaks will occur, *Deluxe* displays a single horizontal line at the bottom of each page. *Deluxe* also makes an effort to display most special printing effects. What it doesn't show on-screen, however, is double spacing, full justification, and, of course, proportional spacing.

Another of *Deluxe*'s strengths is that it lets you work with a variety of formats without making you redo your settings each time you edit. Most of the format options are presented to you in the format menu, which you can call from either the main menu (by choosing F for *format selection*) or the editor (by typing control-F1). The format menu shows you the current settings for line spacing, lines per inch, pitch, justification, proportional spacing, and the like.

Once you have the settings the way you want them, *Deluxe* gives you the option of using them with the file you're editing or storing them in their own file for later use. It's the latter option that gives you the flexibility to switch back and forth between several formats.

Whenever you retrieve a file from disk or create a new file, *Deluxe* looks through the library of formats stored on your data disk and tries to match one of them to your document's filename. First it looks for a format that matches the filename itself; if such a format isn't found, it looks for a format whose three-character extension matches that of your document. For example, if you use the same format for all the letters you write, you might want to set up a format file named Vwformat.ltr. Then, whenever you retrieved or created a file with the extension .ltr, *Deluxe* would automatically load the format file with the same extension.

If you're working on a document that has its own special format — say, a proposal whose filename is Proposal — you could name its format Proposal.fmt. In this case, every time you retrieved Proposal, *Deluxe* would automatically load Proposal.fmt. If you use the same format for all your files, you can give the format file the generic name Vw.fmt, and *Deluxe* will load it for you to use with everything.

Deluxe also allows you to retrieve other formats when you're in the middle of editing. Suppose you want to type a long quotation and you want it single-spaced and indented from both margins. You call the format menu with control-F1, choose R for *retrieve*, and type the name of the format file that contains the appropriate settings; the new settings will take effect at that point in your document.

Although tab and margin settings aren't part of the format menu, *Deluxe* stores them with your format file; *Deluxe* assumes that the tab settings in force when you name and store a new format should be part of that format. The advantage of this approach is that once you go to the trouble of setting up tabs for a complex table you can use them over and over again on other tables.

Changing margins and tab settings is easy enough. Just hit F9 to call the ruler line to the top of the screen and follow *Deluxe*'s prompts. The only hitch is that all tabs are regular typewriter tabs; *Deluxe* simply doesn't do decimal tabs, which is surprising in a program that's sophisticated enough for the office.

Another thing that *Deluxe* doesn't do is provide help with hyphenation. You can't even insert ghost hyphens so that polysyllabic words will split should they fall at the end of a line. Without benefit of hyphens, right margins can become downright tattered (as evidenced by *Deluxe*'s own manual); even worse things happen with full justification, since all those extra spaces are spread throughout the line.

When it comes to special printing effects, however, *Deluxe* comes through with flying colors. For one thing, it's consistent. It assigns all printing effects to the function keys combined with the shift key. For example, shift-F7 turns boldface on and off; shift-F9 does the same with underscore. If you forget to shut off one of these features, *Deluxe* automatically cancels it at the end of the paragraph (or at the end of the line in the case of superscripts or subscripts).

On a monochrome display, *Deluxe* shows both underlining and boldface; strikethrough (also called overstrike) grabs your attention by blinking on and off. *Deluxe* also inserts markers (arrows for boldface and triangles for underlining, for example) to show where special printing features start and stop; this feature helps, for instance, when you want to delete underlining but leave the underlined word alone. If you want to see your text without the symbols, hit control-F3; the markers will temporarily disappear, reappearing as soon as you press any other key.

Also supported are most other printing effects that your printer may be capable of—italics, compressed or expanded print, ribbon shift, and the like. *Deluxe* assigns these features to keys F3 through F6. However, you'll have to experiment on your own to see the effect of each of these keys, since the key assignments differ from printer to printer.

Deluxe uses embedded commands to control such things as text for running headers and footers, forced page breaks, and page numbering. You type these commands at the left margin, preceded by two periods, much in the manner of *WordStar*'s dot commands. The

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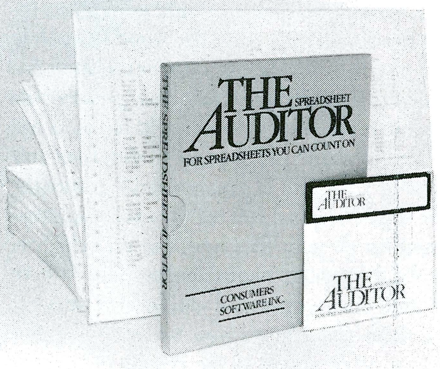

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two periods tell *Deluxe* to treat any text that follows as a command instead of as part of your text. For example, to set up a running head for a book chapter, you might type *..Head03LChapter 5*. This particular command tells *Deluxe* that you want *Chapter 5* to appear as a running head, spaced down three lines from the top of the page and aligned at the left margin. By replacing the L in the above command with an R, C, or A, you can have headers or footers aligned against the right margin, centered, or set flush-left and flush-right on alternate pages.

If you want page numbers printed, you insert the symbols ## within either a header or footer. For example, to have page numbers centered three lines up from the bottom of each page, you'd use the command *..Foot63C##*. As in *WordStar*, you can prevent headers from appearing on the first page of your manuscript by embedding the header command anywhere after the first line of text.

Still other embedded commands allow you to make the printer pause during a printout, insert nonprinting comment lines, and stop printing before the end of the file. You can also do boilerplating by embedding the command *..Print* followed by the name of the file you want inserted. This command tells *Deluxe* to stop printing the current file and start printing the file you name, which in this case is a boilerplate paragraph you've stashed away on disk. Similarly, by embedding the command *..Format*, you can have *Deluxe* retrieve a format from disk at print time, a handy option when you want to change formats in the middle of your document. In fact, by combining the commands *..Print* and *..Format*, you can create a master file that links several files, changing formats between each file.

When you're ready to print, you return to the main menu and choose the *print* option. To print only a portion of your file, just tell *Deluxe* the number of the line or page on which you want the printing started. Or, if you want to do a quick print beginning at the cursor position, you can avoid going back to the main menu by hitting alt-F1 from within the editor.

File Handling. The good news about *Deluxe*'s file handler is that file size is no longer limited by your system's memory. When the file you're working on fills the available RAM, which happens after about seven double-spaced pages on a 128K system, *Deluxe* creates a spill file that holds anything more you add up to the amount of space you have on disk. Since working with spill files means you can't switch disks during the editing process, *Deluxe* gives you the option of doing without spill files. This isn't a bad idea if you have 256K, since with that much memory you can edit up to about forty pages before you run out.

In addition to the standard renaming and deleting utilities, *Deluxe*'s file options include

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inserting a new file at the cursor position and saving your work and continuing to edit. You can't, however, copy files or format a new disk from within the program.

Notepad, a feature that's aimed at scratchpad scribblers, allows you to write yourself notes while editing. Instead of frantically searching for paper and pencil when your broker calls with a hot stock tip, for example, just hit control-F2 and type. *Deluxe* will add to an ongoing notepad file anything you type until the next carriage return; to save a message that extends past a carriage return, you insert block markers (F5 and F6) to note its beginning and end. You can have as many notepad files as you want, and you can name them anything that strikes your fancy—Scratch, Notes, Daydreams, or whatever. Notepad files are also handy for storing footnotes, which you can print at the end of your document by means of embedded commands.

Deluxe is flexible about automatic backup; it's up to you to decide whether the increased security is worth the extra disk space taken up by such files. If you opt for automatic backups, every time you store an updated version of your work to disk, *Deluxe* automatically hangs on to the previous version by giving it the .bak suffix.

For those users interested in having *Deluxe* read the files of other software packages, the manual provides a few specifics about integrating files from *1-2-3*, *VisiCalc*, *SuperCalc*, and *dBase II*. If you're interested in converting *WordStar* files to *Deluxe* format, there's a slick utility that takes care of all *WordStar*'s quirks down to the last dot command.

TextMerge. Another of *Deluxe*'s shiny new features is TextMerge, a no-nonsense program that makes quick work of form letters and mailing labels.

The first step is to create a master document, which may be a form letter, a template for mailing labels, or anything else you want to merge data into. At the top of the master file, you embed the command *..File*, followed by a list of variables—first name, last name, address, each separated by a reverse slash—that correspond to the variables in your mailing list. Then, if you're creating form letters, you type the text for the letter with variable names inserted everywhere you want data to be merged; for mailing labels, you create the template by typing the variable names in the positions at which you want them printed.

You create the mailing list itself by typing all the data for each record (each person's name and address, for example) on one line. Although the one-line limit might sound meager, don't forget that *Deluxe* can accommodate a line length of up to two hundred fifty characters. Extra spaces between variables are ignored, so to make your records more readable you can set a series of tab stops.

When you're ready to merge data into your master document, you call TextMerge from the main menu and follow the prompts that ask for the names of both your master and merge files. *Deluxe* then proceeds to print a copy of the master file for each entry in your mailing list. If you'd like to print form letters for only a portion of your mailing list entries, you can enter the record number where you want to take up merging.

Wir Sprechen Deutsch. Like the International Edition of *Volkswriter*, *Deluxe* is well versed in foreign languages; it comes ready to write in English, German, French, Italian, and Spanish. By combining the alt key with letters and numbers, you can produce vowels with all possible accents and umlauts, as well as foreign currency symbols and any other language-specific characters. *Deluxe* is also compatible with all foreign editions of the PC and their corresponding versions of DOS.

Deluxe goes a step further and lets you redefine the keyboard any way you want by building your own translation table. For example, statisticians or engineers might want to redefine a few keys for easy access to math and Greek symbols. And if you're a fan of the Dvorak keyboard, here's a do-it-yourself way to make the switch.

You give your keyboard translation table a filename that works much like a format file, which means that *Deluxe* will automatically load a different keyboard based on the kind of work you're doing. This is a perfect solution if you share a computer and the *Deluxe* package with someone who doesn't use your specialized keyboard.

Along the same lines, *Deluxe* allows you to set up a printer translation table, which can come in handy if your printer isn't up to producing accented letters, for example. In this case, you'd string together the ASCII values that tell your printer to print the character you want accented, then back up a space, and then print an accent. Although the manual devotes an entire appendix to translation tables, you'll still need some familiarity with your printer.

Documentation and Support. *Deluxe*'s manual provides an introduction to the program, a reference section, an index, and seven appendixes that cover everything from translation tables to trouble-shooting—all this in a slim one-hundred-fifty-page volume. What the manual could use is a quick-reference section for the function keys and maybe a few illustrations and sample screens.

Deluxe also comes with a series of tutorials that reside entirely on disk. While their information is good, they're not very interactive. Mostly, you just read from the screen and experiment on your own. You can, in fact, save yourself a lot of time by printing the tutorials and then just reading them.

Deluxe isn't copy-protected. It's warranted

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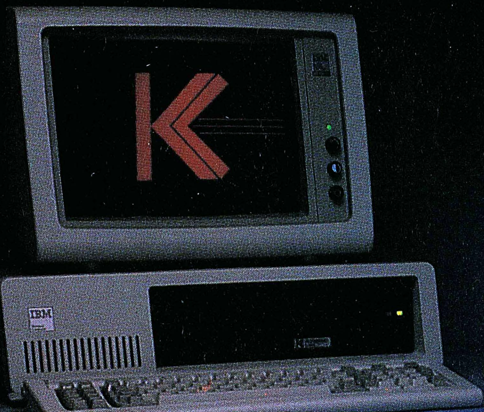

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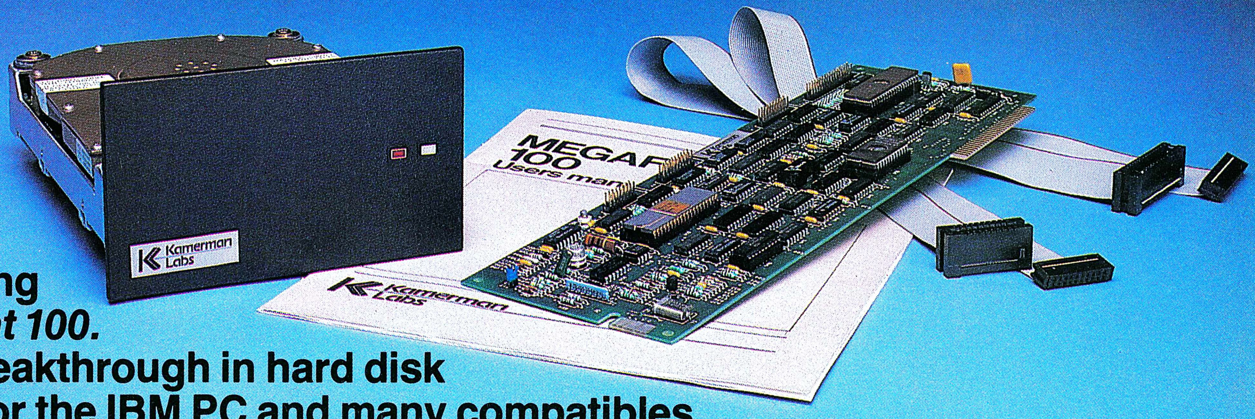

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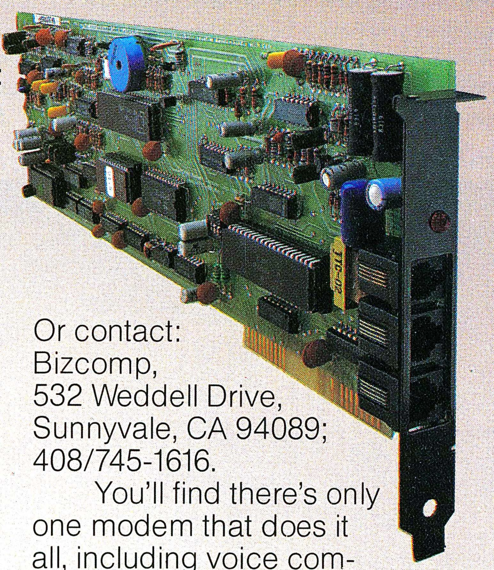

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Ease of Learning and Use. Even though *Deluxe* has a lot more horsepower than the venerable *Volkswriter*, it's not much harder to learn. The main difference between the two programs is that *Volkswriter* uses only the alt key with the function keys while *Deluxe* brings shift and control into the act. Until you work out a system for remembering which command belongs with control and which one with alt, you'll find the optional help menu indispensable.

Deluxe's installation routine is surprisingly simple to follow considering the record number of options it offers. It's here that you indicate whether you want spill files created and automatic backups made. By the time you've finished answering *Deluxe*'s questions, you will have selected your printer and display type, indicated which disk drive will hold your documents, changed display colors if you wish, and even modified your printer table or built a new one from scratch. If all this seems overwhelming, you can always come back later when you have a better idea of what options you want.

If you're a *Volkswriter* user who'd like to move up a notch, you're in for smooth cruising. To get you off to a quick start, Lifetree provides a separate tutorial that tells you most of the differences between the two programs. Fortunately, *Deluxe* has inherited *Volkswriter*'s friendly disposition; it still rebounds from errors like a champ and provides you with an opportunity to call off commands that could end in disaster. It draws the line, however, at retrieving deleted text or files, something that many new word processors can handle.

Deluxe's added baggage hasn't slowed it down a bit. Aside from the inconvenient key combinations that put your left hand's nimbleness to the test, it's a model of efficiency. For the most part, it stays out of your way and keeps keystrokes to a minimum.

Summary. *Deluxe* is a sure bet for people who do word processing in more than one language. Also to its credit, it makes quick work of form letters, does true proportional spacing, and makes switching between formats a breeze. What's more, it's so friendly and efficient that it's hard not to like it. At the same time, however, *Deluxe* has a few inadequacies: Its search and replace features are primitive, and it's absolutely no help with hyphens and decimal tabs—to say nothing of the lack of automatic paragraph reform, keyboard macros, and windows.

System Requirements. *Deluxe* requires 128K and two disk drives (or one floppy drive plus a hard disk). It comes with printer tables for nineteen printers.

Volkswriter Deluxe (version 2.0)
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Palantir Update

Palantir Software is now shipping a new release of *Palantir.* Because they added so many features to version 1.15 (reviewed here last January), the folks at Palantir have numbered the release 2.0 instead of 1.2, as they had planned. The new version requires more memory (128K versus 56K) but costs you less ($395 versus $450).

The most obvious improvement is the manual. *Palantir* is now packaged slip-case style; the newly designed manual has tabs for quick access to the reference section, and the expanded tutorial is keyed to disk files.

New cursor controls include *Find Line* and *Find Page*, as well as backward tabbing by word. Also new is hyphen help with an adjustable hot zone; just set the size of the hot zone from 1 to 9 (the lower the number, the more words hyphenated) and *Palantir* will prompt you when it encounters a word that needs dividing.

Another new feature allows you to run other programs from *Palantir*'s main menu and, when you're finished, return to editing with the cursor where you left it. Also, Mailout, *Palantir*'s mail merge, is now capable of decimal math.

Hard-disk users will be happy to know that the new version supports DOS 2.0 subdirectories. Several new printer drivers are available, including one for the Diablo 630 ECS, and the terminal drivers are memory-mapped to make for speedy screen updates. *Palantir* 2.0 runs on the PC*jr*.

If you're a registered *Palantir* user, you can get the update for $47.50 by returning your original program disk to Palantir Software, 3400 Montrose Boulevard, Suite 718, Houston, TX 77006. Call (800) 368-3797. ▲

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Observers felt that Jack2's ability to prepare documents with live spreadsheets and charts embedded in text, live calculations in the middle of sentences, without windows, makes Jack2 the ultimate in integrated software. "Or," as one observer commented, "words, numbers, and pictures all on the same page is what true integration is all about."

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TRADETALK

∆ **Lotus Development Corporation** (Cambridge, MA) has announced a licensing agreement with **Prelude Development Corporation** (Cambridge, MA); the latter firm will provide artificial intelligence software technology to Lotus.

∆ In response to the training needs of its dealers, **AST Research** (Irvine, CA) has appointed **John Purner** manager of training, reporting directly to Tom Stickel, vice president of sales. Purner will implement and administer a complete training curriculum/seminar package to provide dealers with sales training. Purner comes to AST from CalComp in Anaheim, California, where he was manager of sales and sales support.

∆ **BetaTool Systems** (Denver, CO) is the new name of **SofTool Systems**, the Colorado developer of the *BASIC Development System*, a set of software tools for programming in Basic. According to Ken Snapp, president of BetaTool Systems, the change was necessary to avoid conflict with a California firm that had made prior use of the name SofTool.

∆ **Jerry Ruttenbur** has joined **Microsoft** (Bellevue, WA) as vice president of the retail sales division. He comes to Microsoft from Koala Technologies, where he was vice president of the sales division.

∆ **SKU** (Berkeley, CA) has been chosen by **Waldenbooks** (Stamford, CT) to provide between one hundred and one hundred twenty-five titles to more than sixty Waldenbooks stores in Washington, D.C., Cincinnati, and Chicago. Titles will include a selection of entertainment, educational, business, and home management software. Steve Cunningham, SKU vice president of sales, noted that "bookstores have been trying to determine whether or not they should be in the software business. Now it appears that the industry is committed to software. The book industry is emerging as the largest single source of retail software sales because of the huge volume of foot traffic it generates."

∆ **Innovative Software** (Overland Park, KS) is bundling its *TIM IV* database manager software program with all personal computers sold by **Columbia Data Corporation** (Columbia, MD). Michael J. Brown, president of Innovative, expects *TIM IV*'s installed user base of over twenty thousand to double in size as a result of the agreement.

∆ **BKW Systems** (Nashua, NH), which designs, develops, markets, installs, and services integrated, on-line hardware/software solutions for banks and financial institutions, reported a loss of $345,014 on revenues of $2,938,172 during its second fiscal quarter ending March 31, 1984. For the corresponding period in 1983, the company reported net income of $227,639 on revenues of $729,886. Al Fichera, Jr., chairman of the board and chief executive officer of BKW, characterized the results as "consistent with management's expectations."

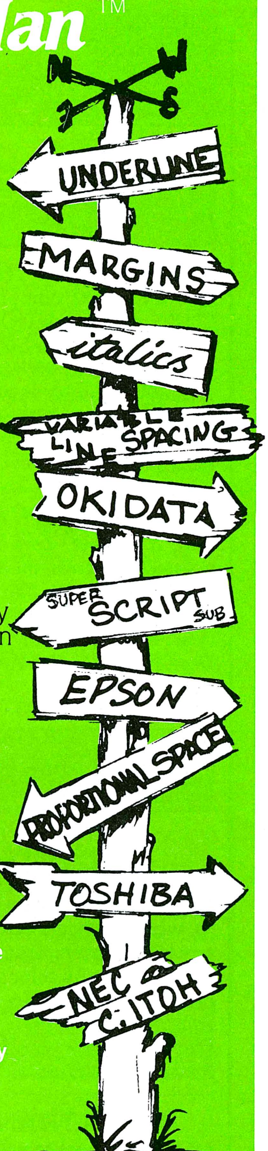
∆ Microcomputer software producers are rapidly moving toward the standard marketing tools of the publishing industry, according to Emery Koltay, director of the **U.S. ISBN Agency** (New York, NY). "More than 39 percent of our monthly requests for new ISBNs have been coming from the microcomputer software industry, and it seems to be escalating," said Koltay.

∆ **Compaq Computer Corporation** (Houston, TX) has expanded its corporate operations. Compaq president **Rod Canion** has announced the introduction of Compaq products in Europe, the creation of a telecommunications subsidiary, and the creation of three new corporate divisions—the Portable Computer division, the Office Computer division, and the Advanced Computer division. The company's overseas operations, headquartered in Munich, are directed by **Eckhard Pfeiffer**, vice president, European operations. Pfeiffer previously spent twenty-eight years with Texas Instruments. **Compaq Telecommunications** is based in Dallas and will develop advanced telecommunications technologies that will be reflected in future products.

∆ **William G. Allin** has been named vice president, marketing, for **Softmart** (Philadelphia, PA), a franchisor of retail software stores featuring software and accessories exclusively for the IBM PC and PC compatibles. Allin, who will be primarily responsible for marketing the Softmart franchises, is a former franchise development officer for Entre Computer Centers.

∆ **Sysgen** (Fremont, CA), a manufacturer of multifunction controllers and disk-tape backup systems for personal computers, has received an order valued at approximately $5 million from **Hospital Corporation of America** (Nashville, TN) for the Sysgen II-G-20, which incorporates a twenty-megabyte Winchester disk and quarter-inch streaming tape cartridge backup. The PCs will be used to analyze Medi-

continued on page 68



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continued from page 65

care and Medicaid reimbursements. HCA owns and manages 395 hospitals worldwide.

Δ **Virtual Combinatics** (Rockport, MA) has obtained the rights from **Dorrison House Publishers** (Boston, MA) to publish software editions of three of Dorrison's specialty cookbooks: *A New Look at Microwave Cooking, World of Wok Cooking*, and *Food Processor Cookery.*

Δ **GMS Systems** (New York, NY) has changed its corporate name to **PowerBase Systems**, thereby joining the list of firms that have renamed themselves after their most successful products.

Δ **Orchid Technology** (Fremont, CA) has announced a 29 percent price reduction of *PCnet*—from $695 to $495. The new price was effective May 1.

Δ **John K. Abely**, president of **Technical Publishing Company** (New York, NY), and **Frederick J. Mazanec**, president of **Ironoak Company** (La Jolla, CA), have announced the signing of an agreement in principle under which Technical will acquire the business of Ironoak. Ironoak publishes buyers' guides for microcomputer systems integrators, including the *IBM PC Buyers' Guide*. Mazanec will remain as publisher of the buyers' guides.

CALENDAR

June 5–9: Rochester Forth Applications Conference; University of Rochester, Rochester, NY

June 6–8: SNA (Systems Network Architecture) Architecture and Implementation; Sheraton International, Chicago

June 8–10: 1984 Kansas Computer Exhibition and Robotics Conference; Century II Convention Center, Wichita, KS

June 13–15: PC World Exposition; McCormick Place West, Chicago

June 13–15: NECC (National Educational Computing Conference) '84; Dayton Convention Center, Dayton, OH

June 14–17: International Computer Show; Cologne, West Germany

June 15–17: Computerfest '84, Midwest Affiliation of Computer Clubs; Dayton Convention Center; Dayton, OH

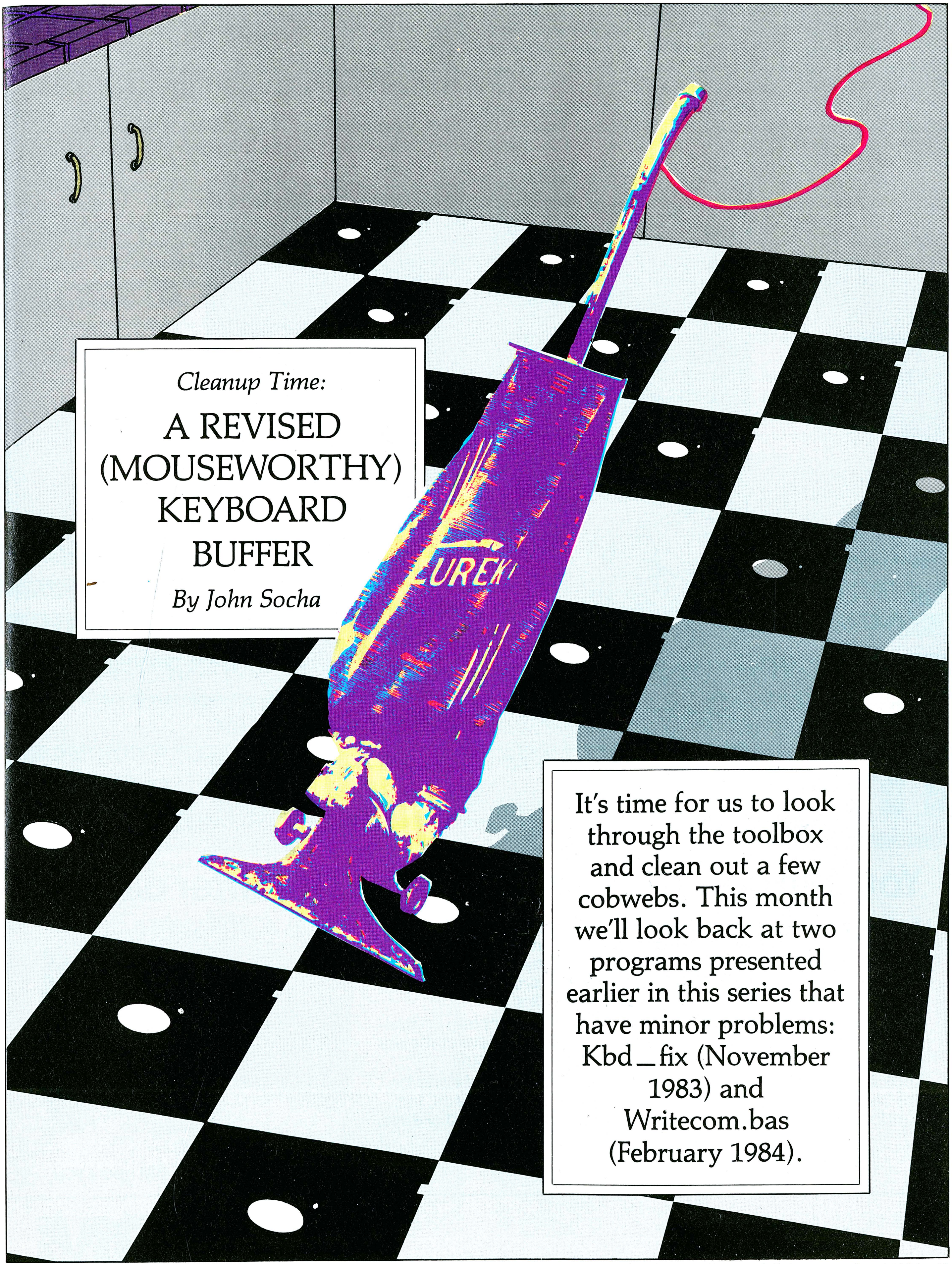
June 21–23: Great Southern Computer Show/Jacksonville; Veterans Memorial Coliseum, Jacksonville, FL

June 26–28: Government Computer Expo'84; Sheraton Washington Hotel; Washington, DC

June 26–28: PCExpo; New York Coliseum, New York

July 3–5: 1984 PC User Show; Novotel (formerly Cunard International), London

July 9–12: National Computer Conference; Las Vegas Convention Center, Las Vegas, NV ▲



Cleanup Time:

A REVISED (MOUSEWORTHY) KEYBOARD BUFFER

By John Socha

It's time for us to look through the toolbox and clean out a few cobwebs. This month we'll look back at two programs presented earlier in this series that have minor problems: Kbd_fix (November 1983) and Writecom.bas (February 1984).

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There was a bug in the original version of Kbd_fix.com that kept it from working with certain application programs, such as *1-2-3*. That bug was exterminated in a followup article (January 1984)—and that should have been the end of any problems associated with Kbd_fix. But it wasn't. Along came the Microsoft Mouse; the mouse and Kbd_fix didn't get along.

This article refixes Kbd_fix to make it compatible with the Microsoft Mouse. In the process of remodeling Kbd_fix, we'll also take care of a small bug in Writecom.bas.

But before we get to all that, let's quickly review the subject of the keyboard buffer.

Every time you push a key, your IBM PC puts the ASCII code associated with that key into an area of memory known as a buffer. This buffer has room for as many as fifteen characters; if you try to put more than fifteen keystrokes into the buffer, your PC will beep at you, indicating that the buffer is full. Most of the time, your PC has no trouble reading and processing characters faster than you type them. But there are times when your computer is too busy to handle your keyboard input and when a fifteen-character buffer may not be large enough.

Kbd_fix extended the capacity of the PC's internal keyboard buffer from 15 to 159 characters. Our revised program, Kbd_buf, does the same and, unlike its predecessor, also works with both *1-2-3* and the Microsoft Mouse.

Kbd_buf is a machine language program—specifically, a .com file. But you don't need to know anything about machine language to build or use it; BASIC will do all the work for you.

Figure 1 shows the BASIC program that creates Kbd_buf.com and stores it on your disk. Just type in this program and run it once to build and store Kbd_buf. The data statements have a number of checks in them; if you mistype some of the numbers, these checks will tell you on which lines you've made mistakes.

But the rest of the program can't check itself. So, before you run the program, proofread lines 100 through 480.

After you've run the program in figure 1, you should have Kbd_buf.com on your disk. This is the machine language program that extends your keyboard buffer. Kbd_buf attaches itself to DOS each time you run it. You should run it only once—each time you start DOS; if you attach it to DOS more than once, you'll find that your PC won't read characters from the keyboard until you restart DOS.

To attach Kbd_buf to DOS and extend your keyboard buffer, just type *kbd_buf* after the DOS prompt.

To run Kbd_buf automatically each time you start DOS, add the line "kbd_buf" to your Autoexec.bat file. If you're also using Scrollk.com (see "The Scroll Lock Mystery Solved," *Softalk*, May 1983), run Kbd_buf before running Scrollk. And if you're using *ProKey*, you'll want to run Kbd_buf first, since Kbd_buf won't read *ProKey*'s macros otherwise. If you're using all three programs—*ProKey*, Scrollk, and Kbd_buf—your batch file should look like this:

KBD_BUF
SCROLLK
PROKEY/I (replace this with PKLOAD if you're using *ProKey* version 3.0 or later)

If you've been a reader of "Socha's Toolbox" for a while, you'll recall that the February installment presented and discussed Writecom.bas, the BASIC program that creates all the various machine language programs presented in this series. Figure 1 also corrects a minor flaw in the version of Writecom.bas presented in February.

Makedata, the program that creates the data statements from a .com file, does a bit of compaction. Some of the programs in the Toolbox series have a large number of zeros in them. So rather than write down a long list of zeros, Makedata writes a −1 followed by a number that represents the number of zeros. For example, in line 1020 of this month's figure 1, 320 zeros (for the keyboard buffer) have been compressed into two numbers: −1, 320.

Writecom also checks the data for errors; if it finds a number larger than 255, it assumes you've forgotten to type a comma. The problem is

```
100 READ LENGTH.%, CHECK.SUM.%, FILE.NAME.$
110 NUM.LINES.% = (LENGTH.% + 7) \ 8
120 DIM CHECK.%(NUM.LINES.%)
130 FOR I.% = 1 TO NUM.LINES.% : CHECK.%(I.%) = 0 : NEXT I.%
140 PRINT "Checking";
150 FOR I.% = 1 TO LENGTH.%
160  READ BYTE.!
170  IF (BYTE.! 〉 255) AND (LAST.BYTE.! 〈〉 −1) THEN 210
180   BYTE.% = BYTE.!
190   CHECK.%(1 + (I.% − 1) \ 8) = CHECK.%(1 + (I.% − 1) \ 8) XOR BYTE.% : GOTO 230
200  'else
210   PRINT : PRINT "Line";1010 + 10 * ((I.% − 1) \ 8)0!;"may have a missing comma."
220   PRINT "Writing stopped." : GOTO 480
230  IF (I.% MOD 8 = 1) THEN PRINT ".";
235  LAST.BYTE.! = BYTE.!
240 NEXT I.%
250 PRINT
260 ERROR.% = 0              'No error yet
270 FOR I.% = 1 TO NUM.LINES.%
280  READ CHECK.% : LINE.CHECK.% = LINE.CHECK.% XOR CHECK.%
290  IF CHECK.%(I.%) 〈〉 CHECK.% THEN PRINT "Line";1000 + 10 * I.%;"May be bad" : ERROR.% = −1
300 NEXT I.%
310 IF LINE.CHECK.% = CHECK.SUM.% THEN 330
320 PRINT "Data may be bad in data starting at line 10000" : ERROR.% = −1
330 IF ERROR.% THEN 480
340 OPEN FILE.NAME.$ AS #1 LEN = 1
350 FIELD #1,1 AS BYTE.$ : PRINT "Writing";
360 RESTORE 1010            'Restore all except for first line of data
370 FOR I.% = 1 TO LENGTH.%
380  READ BYTE.%
390  IF BYTE.% 〈〉 −1 THEN 430
400   READ COUNT.% : LSET BYTE.$ = CHR$(0) : I.% = I.% + 2
410   FOR J.% = 1 TO COUNT.% : PUT #1 : NEXT J.%
420   READ BYTE.%
430  LSET BYTE.$ = CHR$(BYTE.%) : PUT #1
440  IF (I.% MOD 8 = 1) THEN PRINT ".";
450 NEXT I.%
460 CLOSE
470 PRINT : PRINT FILE.NAME.$;" created"
480 END
1000 DATA   390,    418,    "kbd_buf.com"
1010 DATA   233,    113,    2,      −1,     8,      15,     1,      15
1020 DATA   1,      −1,     320,    80,     83,     81,     156,    250
1030 DATA   187,    30,     0,      228,    97,     80,     36,     252
1040 DATA   230,    97,     185,    60,     0,      226,    254,    12
1050 DATA   2,      230,    97,     185,    60,     0,      226,    254
1060 DATA   75,     117,    235,    88,     230,    97,     157,    89
1070 DATA   91,     88,     195,    187,    64,     0,      142,    219
1080 DATA   250,    139,    30,     26,     0,      59,     30,     28
1090 DATA   0,      117,    29,     187,    30,     0,      137,    30
```

```
1100 DATA   26,     0,      131,    195,    2,      137,    30,     28
1110 DATA   0,      140,    203,    142,    219,    187,    15,     1
1120 DATA   137,    30,     11,     1,      137,    30,     13,     1
1130 DATA   251,    195,    30,     86,     83,     80,     187,    64
1140 DATA   0,      142,    219,    46,     139,    54,     13,     1
1150 DATA   139,    30,     26,     0,      131,    195,    2,      131
1160 DATA   251,    62,     114,    3,      187,    30,     0,      59
1170 DATA   30,     28,     0,      116,    45,     139,    7,      46
1180 DATA   137,    4,      131,    198,    2,      129,    254,    79
1190 DATA   2,      114,    3,      190,    15,     1,      46,     59
1200 DATA   54,     11,     1,      117,    10,     232,    107,    255
1210 DATA   46,     139,    54,     13,     1,      235,    5,      46
1220 DATA   137,    54,     13,     1,      137,    30,     26,     0
1230 DATA   235,    194,    88,     91,     94,     31,     195,    30
1240 DATA   83,     80,     232,    118,    255,    156,    46,     255
1250 DATA   30,     3,      1,      232,    156,    255,    187,    64
1260 DATA   0,      142,    219,    160,    23,     0,      36,     12
1270 DATA   60,     12,     117,    8,      46,     161,    13,     1
1280 DATA   46,     163,    11,     1,      88,     91,     31,     207
1290 DATA   251,    30,     83,     232,    77,     255,    232,    121
1300 DATA   255,    140,    203,    142,    219,    10,     228,    116
1310 DATA   12,     128,    252,    1,      116,    41,     91,     31
1320 DATA   46,     255,    46,     7,      1,      251,    144,    250
1330 DATA   139,    30,     11,     1,      59,     30,     13,     1
1340 DATA   116,    243,    139,    7,      131,    195,    2,      129
1350 DATA   251,    79,     2,      117,    3,      187,    15,     1
1360 DATA   137,    30,     11,     1,      91,     31,     207,    250
1370 DATA   139,    30,     11,     1,      59,     30,     13,     1
1380 DATA   139,    7,      251,    91,     31,     202,    2,      0
1390 DATA   30,     184,    −1,     2,      142,    216,    250,    161
1400 DATA   36,     0,      46,     163,    3,      1,      161,    38
1410 DATA   0,      46,     163,    5,      1,      199,    6,      36
1420 DATA   0,      251,    2,      140,    14,     38,     0,      251
1430 DATA   161,    88,     0,      46,     163,    7,      1,      161
1440 DATA   90,     0,      46,     163,    9,      1,      199,    6
1450 DATA   88,     0,      36,     3,      140,    14,     90,     0
1460 DATA   184,    64,     0,      142,    216,    250,    187,    30
1470 DATA   0,      137,    30,     26,     0,      199,    7,      −1
1480 DATA   2,      131,    195,    2,      137,    30,     28,     0
1490 DATA   251,    186,    116,    3,      205,    39
10000 '
10010 DATA  −148, −374,     168,    18,     28,     206,    110,    76
10020 DATA  90,     211,    167,    6,      136,    202,    78,     42
10030 DATA  249,    250,    214,    63,     95,     62,     182,    47
10040 DATA  108,    202,    206,    84,     125,    119,    104,    104
10050 DATA  182,    200,    117,    236,    182,    251,    −170,   44
10060 DATA  108,    166,    211,    30,     167,    241,    −78,    203
10070 DATA  220
```

Figure 1.

that sometimes we may want to use a number larger than 255; in line 1020, for example, we have 320, which is certainly larger than 255.

The new version of Writecom in figure 1 looks to see whether the last number it has read is −1; if it is, the program doesn't check to see whether the number following is larger than 255. We'll be using this modified version of Writecom from now on.

We won't go into the details of how Kbd_buf works, since those details can be found in the original article. But let's take a quick look at why the original version—Kbd_fix—doesn't work with the Microsoft Mouse.

Kbd_fix puts itself in front of the ROM BIOS routines that read characters from the keyboard. Each time you strike a key, Kbd_fix passes control to the ROM BIOS routine, which may or may not put a character into the fifteen-character buffer (when the ROM BIOS routine reads certain keystrokes, such as those produced by the shift keys, it doesn't put any characters in the buffer).

After the ROM BIOS routine has had a chance to put a character into the fifteen-character buffer, Kbd_fix comes along and checks to see if there's a character in the buffer; if it finds one there, it transfers that character into its own 159-character buffer. Kbd_fix checks for only one character at a time. If you have a program that stuffs characters directly into the keyboard buffer (as does the Microsoft Mouse, for example), Kbd_fix misses most of these characters.

The new version, Kbd_buf, keeps on checking for characters until the fifteen-character buffer is empty. That way, Kbd_buf reads all the characters stuffed directly into the fifteen-character buffer.

Besides continuing to check for characters until the fifteen-character buffer is empty, Kbd_buf differs from Kbd_fix in one other important way: It checks for characters not only after a call to the ROM BIOS keyboard routine (INT 9H) but also after any program has tried to read characters from the keyboard using INT 16H. So, unlike Kbd_fix, which failed to catch characters input via the Microsoft Mouse, Kbd_buf should catch all characters sent directly to the keyboard buffer by any program. ▲

```
VECTORS         SEGMENT AT 0H
        ORG     9H*4
KEYBOARD_INT_VECTOR     LABEL   DWORD
        ORG     16H*4
KEYBOARD_IO_VECTOR      LABEL   DWORD
VECTORS         ENDS


ROM_BIOS_DATA   SEGMENT AT 40H
        ORG     17H
KBD_FLAG        DB      ?
        ORG     1AH
ROM_BUFFER_HEAD DW      ?
ROM_BUFFER_TAIL DW      ?
KB_BUFFER       DW      16 DUP (?)
KB_BUFFER_END   LABEL   WORD
ROM_BIOS_DATA   ENDS


CODE_SEG        SEGMENT
        ASSUME  CS:CODE_SEG
        ORG     100H
BEGIN:  JMP     INIT_VECTORS                    ;Initialize vectors and attach to DOS

ROM_KEYBOARD_INT        DD                      ;Address for ROM routine
ROM_KEYBOARD_IO         DD
BUFFER_HEAD             DW      OFFSET KEYBOARD_BUFFER
BUFFER_TAIL             DW      OFFSET KEYBOARD_BUFFER
KEYBOARD_BUFFER         DW      160 DUP (0)     ;160-character input buffer
KEYBOARD_BUFFER_END     LABEL   WORD


;-----------------------------------------------------------------------;
; This procedure sends a short beep when the buffer fills.              ;
;-----------------------------------------------------------------------;
KB_CONTROL      EQU     61H     ;Control bits for keyboard (and speaker)
ERROR_BEEP      PROC    NEAR
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSHF                   ;Save the old interrupt enable flag
        CLI                     ;Turn off beep during interrupt
        MOV     BX,30           ;Number of cycles for 1/8-second tone
        IN      AL,KB_CONTROL   ;Get control information from speaker port
        PUSH    AX              ;Save the control information
START_OF_ONE_CYCLE:
        AND     AL,0FCH         ;Turn off the speaker
        OUT     KB_CONTROL,AL
        MOV     CX,60           ;Delay for first half cycle
OFF_LOOP:
        LOOP    OFF_LOOP
        OR      AL,2            ;Turn on the speaker
        OUT     KB_CONTROL,AL
        MOV     CX,60           ;Delay for second half cycle
ON_LOOP:
        LOOP    ON_LOOP
        DEC     BX              ;200 cycles yet?
        JNZ     START_OF_ONE_CYCLE
        POP     AX              ;Recover old keyboard information
        OUT     KB_CONTROL,AL
        POPF                    ;Restore interrupt flag
        POP     CX
        POP     BX
        POP     AX
        RET
ERROR_BEEP      ENDP


;-----------------------------------------------------------------------;
; This procedure checks the ROM keyboard buffer to see if some program  ;
; has tried to clear this buffer. We know it's been cleared when the    ;
; ROM tail and header overlap. Normally, the new procedure below        ;
; keeps a dummy character in the buffer.                                ;
;                                                                       ;
; Uses: BX, DS                                                          ;
; Writes:       BUFFER_HEAD, BUFFER_TAIL, ROM_BUFFER_HEAD,              ;
;               ROM_BUFFER_TAIL                                         ;
; Reads:        KEYBOARD_BUFFER, KB_BUFFER                              ;
;-----------------------------------------------------------------------;
CHECK_CLEAR_BUFFER      PROC    NEAR
        ASSUME  DS:ROM_BIOS_DATA
        MOV     BX,ROM_BIOS_DATA        ;Establish pointer to BIOS data
        MOV     DS,BX
        CLI                             ;Turn off interrupts during this check
        MOV     BX,ROM_BUFFER_HEAD      ;Check to see if buffer cleared
        CMP     BX,ROM_BUFFER_TAIL      ;Is the buffer empty?
        JNE     BUFFER_OK               ;No, then everything is
                                        ;Yes, then clear the internal buffer
        MOV     BX,OFFSET KB_BUFFER     ;Reset the buffer with word 0 in buffer
        MOV     ROM_BUFFER_HEAD,BX
        ADD     BX,2
        MOV     ROM_BUFFER_TAIL,BX
        ASSUME  DS:CODE_SEG
        MOV     BX,CS
        MOV     DS,BX
        MOV     BX,OFFSET KEYBOARD_BUFFER       ;Reset internal buffer
        MOV     BUFFER_HEAD,BX
        MOV     BUFFER_TAIL,BX
BUFFER_OK:
        ASSUME  DS:CODE_SEG
        STI                             ;Interrupts back on
        RET
CHECK_CLEAR_BUFFER      ENDP

;-----------------------------------------------------------------------;
; This procedure checks to see if there are any new characters in the   ;
; ROM BIOS keyboard buffer; if there are, it stuffs them into           ;
; the extended keyboard buffer here.                                    ;
;-----------------------------------------------------------------------;
CHECK_FOR_NEW_CHARACTERS        PROC    NEAR
        PUSH    DS
        PUSH    SI
        PUSH    BX
        PUSH    AX
        ASSUME  DS:ROM_BIOS_DATA
        MOV     BX,ROM_BIOS_DATA
        MOV     DS,BX                   ;Set DS for ROM BIOS keyboard buffer
        MOV     SI,BUFFER_TAIL
        MOV     BX,ROM_BUFFER_HEAD      ;Check if real character in buffer
CHECK_FOR_CHARACTER:
        ADD     BX,2                    ;Skip over dummy character
        CMP     BX,OFFSET KB_BUFFER_END ;Check for wraparound
        JB      DONT_WRAP               ;No need to wrap the pointer
        MOV     BX,OFFSET KB_BUFFER     ;Wrap the pointer
DONT_WRAP:
        CMP     BX,ROM_BUFFER_TAIL      ;Is there a real character?
        JE      NO_NEW_CHARACTERS       ;No, then return to caller
        MOV     AX,[BX]                 ;Yes, move character to internal buffer
        MOV     CS:[SI],AX
        ADD     SI,2                    ;Move to next position
        CMP     SI,OFFSET KEYBOARD_BUFFER_END   ;Check for wraparound
        JB      NOT_AT_END
        MOV     SI,OFFSET KEYBOARD_BUFFER
NOT_AT_END:
        CMP     SI,BUFFER_HEAD          ;Buffer overrun?
        JNE     WRITE_TO_BUFFER         ;No, then write character to buffer
        CALL    ERROR_BEEP              ;Yes, beep and throw out character
        MOV     SI,BUFFER_TAIL          ;Reset SI to end of buffer
        JMP     SHORT NOT_AT_KB_END
WRITE_TO_BUFFER:
        MOV     BUFFER_TAIL,SI
NOT_AT_KB_END:
        MOV     ROM_BUFFER_HEAD,BX
        JMP     CHECK_FOR_CHARACTER     ;Check if another character in buffer

NO_NEW_CHARACTERS:
        POP     AX
        POP     BX
        POP     SI
        POP     DS
        RET
CHECK_FOR_NEW_CHARACTERS        ENDP

;-----------------------------------------------------------------------;
; This procedure intercepts the keyboard interrupt and moves any new    ;
; characters to the eighty-character buffer.                            ;
;-----------------------------------------------------------------------;
INTERCEPT_KEYBOARD_INT  PROC    NEAR
        ASSUME  DS:NOTHING
        PUSH    DS
        PUSH    BX
        PUSH    AX
        CALL    CHECK_CLEAR_BUFFER      ;Check for buffer cleared
        PUSHF
        CALL    ROM_KEYBOARD_INT        ;Read scan code with BIOS routines
        CALL    CHECK_FOR_NEW_CHARACTERS        ;Transfer any new characters

;------ See if CTRL + ALT pushed, and clear buffer if so

        ASSUME  DS:ROM_BIOS_DATA
        MOV     BX,ROM_BIOS_DATA
        MOV     DS,BX                   ;Set DS for ROM BIOS keyboard buffer
        MOV     AL,KBD_FLAG             ;Get status of shift keys into AL
        AND     AL,0CH                  ;Isolate Alt and Ctrl shift flags
        CMP     AL,0CH                  ;Are both the Ctrl and Alt keys down?
        JNE     DONT_CLEAR_BUFFER       ;No, then don't clear the buffer
        MOV     AX,BUFFER_TAIL          ;Yes, then clear the buffer
        MOV     BUFFER_HEAD,AX

DONT_CLEAR_BUFFER:
```

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```
        POP     AX
        POP     BX
        POP     DS
        IRET
INTERCEPT_KEYBOARD_INT  ENDP


;----------------------------------------------------------------------;
; This procedure replaces the ROM BIOS routines for reading a character ;
;----------------------------------------------------------------------;
        ASSUME  DS:CODE_SEG
INTERCEPT_KEYBOARD_IO   PROC    FAR
        STI                             ;Interrupts back on
        PUSH    DS                      ;Save current DS
        PUSH    BX                      ;Save BX temporarily
        CALL    CHECK_CLEAR_BUFFER      ;Check for buffer cleared
        CALL    CHECK_FOR_NEW_CHARACTERS        ;Transfer new characters
        MOV     BX,CS                   ;Establish pointer to data area
        MOV     DS,BX
        OR      AH,AH                   ;AH=0?
        JZ      READ_CHARACTER          ;Yes, read a character
        CMP     AH,1                    ;AH=1?          **********
        JZ      READ_STATUS             ;Yes, return the status
        POP     BX                      ;Let ROM BIOS handle other functions
        POP     DS
        ASSUME  DS:NOTHING
        JMP     ROM_KEYBOARD_IO         ;Call ROM BIOS for other functions

;------ Read the key

        ASSUME  DS:CODE_SEG
READ_CHARACTER:                         ;ASCII read
        STI                             ;Interrupts back on during loop
        NOP                             ;Allow an interrupt to occur
        CLI                             ;Interrupts back off
        MOV     BX,BUFFER_HEAD          ;Get pointer to head of buffer
        CMP     BX,BUFFER_TAIL          ;Test end of buffer
        JE      READ_CHARACTER          ;Loop until something in buffer
        MOV     AX,[BX]                 ;Get scan code and ASCII code
        ADD     BX,2                    ;Move to next word in buffer
        CMP     BX,OFFSET KEYBOARD_BUFFER_END   ;At end of buffer?
        JNE     SAVE_POINTER            ;No, continue
        MOV     BX,OFFSET KEYBOARD_BUFFER       ;Yes, reset to buffer start
SAVE_POINTER:
        MOV     BUFFER_HEAD,BX          ;Store value in variable
        POP     BX
        POP     DS
        IRET                            ;Return to caller

;------ ASCII status

READ_STATUS:
        CLI                             ;Interrupts off
```

```
        MOV     BX,BUFFER_HEAD          ;Get head pointer
        CMP     BX,BUFFER_TAIL          ;If equal (ZF = 1) then nothing there
        MOV     AX,[BX]
        STI                             ;Interrupts back on
        POP     BX                      ;Recover registers
        POP     DS
        RET     2                       ;Throw away flags
INTERCEPT_KEYBOARD_IO   ENDP


;-----------------------------------------------------------------------;
; This procedure initializes the interrupt vectors.                      ;
;-----------------------------------------------------------------------;
INIT_VECTORS    PROC    NEAR
        ASSUME  DS:VECTORS
        PUSH    DS                      ;Save old data segment
        MOV     AX,VECTORS              ;Set up the data segment for vectors
        MOV     DS,AX
        CLI                             ;Don't allow interrupts
        MOV     AX,KEYBOARD_INT_VECTOR  ;Save addresses of BIOS routines
        MOV     ROM_KEYBOARD_INT,AX
        MOV     AX,KEYBOARD_INT_VECTOR[2]
        MOV     ROM_KEYBOARD_INT[2],AX
                                        ;Set up new KEYBOARD_INT vector
        MOV     KEYBOARD_INT_VECTOR, OFFSET INTERCEPT_KEYBOARD_INT
        MOV     KEYBOARD_INT_VECTOR[2],CS
        STI                             ;Allow interrupts again
                                        ;Set up KEYBOARD_IO vector
        MOV     AX,KEYBOARD_IO_VECTOR
        MOV     ROM_KEYBOARD_IO,AX
        MOV     AX,KEYBOARD_IO_VECTOR[2]
        MOV     ROM_KEYBOARD_IO[2],AX
        MOV     KEYBOARD_IO_VECTOR, OFFSET INTERCEPT_KEYBOARD_IO
        MOV     KEYBOARD_IO_VECTOR[2],CS
                                        ;Now set up the keyboard buffer, etc.
        ASSUME  DS:ROM_BIOS_DATA
        MOV     AX,ROM_BIOS_DATA
        MOV     DS,AX
        CLI                             ;Don't allow interrupts now
        MOV     BX,OFFSET KB_BUFFER
        MOV     ROM_BUFFER_HEAD,BX
        MOV     WORD PTR [BX],0
        ADD     BX,2
        MOV     ROM_BUFFER_TAIL,BX
        STI                             ;Allow interrupts again

        MOV     DX,OFFSET INIT_VECTORS  ;End of resident portion
        INT     27H                     ;Terminate but stay resident
INIT_VECTORS    ENDP

CODE_SEG        ENDS

        END     BEGIN
```

▲

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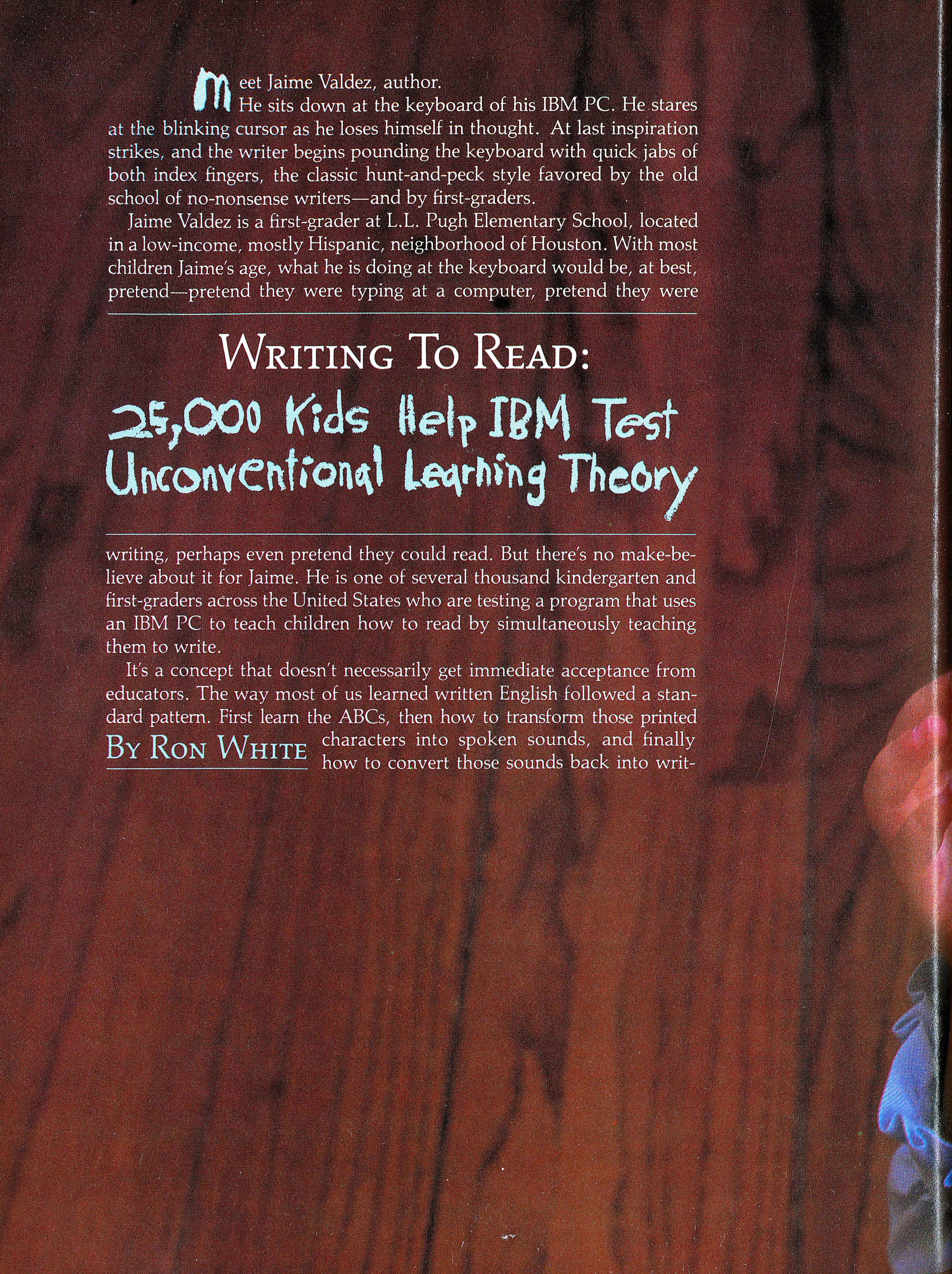


Meet Jaime Valdez, author.

He sits down at the keyboard of his IBM PC. He stares at the blinking cursor as he loses himself in thought. At last inspiration strikes, and the writer begins pounding the keyboard with quick jabs of both index fingers, the classic hunt-and-peck style favored by the old school of no-nonsense writers—and by first-graders.

Jaime Valdez is a first-grader at L.L. Pugh Elementary School, located in a low-income, mostly Hispanic, neighborhood of Houston. With most children Jaime's age, what he is doing at the keyboard would be, at best, pretend—pretend they were typing at a computer, pretend they were

WRITING TO READ:

25,000 Kids Help IBM Test Unconventional Learning Theory

writing, perhaps even pretend they could read. But there's no make-believe about it for Jaime. He is one of several thousand kindergarten and first-graders across the United States who are testing a program that uses an IBM PC to teach children how to read by simultaneously teaching them to write.

It's a concept that doesn't necessarily get immediate acceptance from educators. The way most of us learned written English followed a standard pattern. First learn the ABCs, then how to transform those printed characters into spoken sounds, and finally how to convert those sounds back into writ-

BY RON WHITE

WRITING
TO READ

ing. The logic behind the scheme appears irrefutable. After all, how can you write a word if you haven't read it first?

Don't be too sure. First read Jaime's story. It's called "Space."

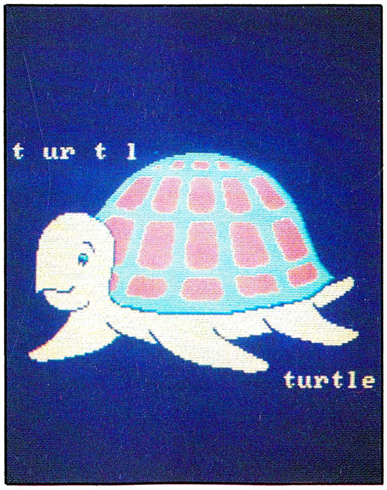
One day I wanted to go to Mars and I did. I bilt a space chair, it goes up. I saw a marchen her name was Patty we made frieds. She had a green mother and father. I took her back to Earth. Then she said can my mother and father come to see Earth. I said yes. Then we went to go get them. We played for a little bit. Then we went to Saturn we saw marchens that came from mars they wher very friendly. We stayed thar for a long time. While we wher thar we saw rings around it that look like icesicles they shined bright. The peopel wher blue green. whith seven eyes, three mouths, and one leg and no nose. they had stors that look like klenexs boxes. The close looks like flowers. The flowers look like medacen bottles. The kids do not go to school. They lern by home computers. They eat potato pills. they drink milk from the milkyway factory. For desert they eat marshmelos. their houses look like milk cartens.

Or here's a story by another first-grader, more down-to-earth but still filled with writing skills few children in the first grade attain. The piece is a variation on the classic theme, "What I Did on My Vacation." It's written by Luis Guerra.

My Spring Vacation

I went to Mexico before we got there we went to McAllen. We went to a store there then we got into the car and went to Mexico. On the way I saw some cows and horses and the big dipper it was big and shiny. I went to my cousins house they had some chickens and some birds and a big cow and some turkys. We helped feed the animals. Sometimes me and my brother and cousin would go to a store across the river. I had a cake for my birthday in Mexico. One day we went to Monterrey and bought some records and cakes To get to Monterey we had to drive through a divided mountain. It was very high and very pretty my ears would pop when we went through the mountains. We did not want to come back to Houston. We enjoyed our spring vacation very much.

Of course, even softcore grammarians will notice some original spelling and punctuation in both pieces. But you'll also notice Jaime and Luis writing words that, while they're in many six-year-olds' vocabularies, can't be found in first-grade primers. And what's more important, Jaime and Luis are not particularly exceptional children. But like many of the other first-graders at Pugh, they are writing whole paragraphs and reading third- and fourth-grade books.



(Above) *An example of the graphics used in the* Writing To Read *program.* (Top) *Clockwise from lower left: Esteban Graham, Anh Tien, Aaron Phillips, Monika Cortez, Gracie Medina show off their PC and* Writing To Read software.

The results among the kindergarten and first-grade children at Pugh are typical of the way some twenty-five hundred children in 225 schools across the country have picked up reading and writing during a two-year test by IBM of a program called *Writing To Read*. The Educational Testing Service in Princeton, New Jersey, is doing a thorough study of the test program and will release the formal results of the experiment this summer. But a few scattered results already in, plus the informal reactions of teachers, indicate that the program may be a giant step in computerized education.

In the Raleigh-Wake County school system in North Carolina, for example, four hundred kindergarten students who have gone through the *Writing To Read* program were compared to a control group that was taught reading and writing through a different, but still enriched, program. All the students were given the California Achievement Test, and the results for the noncomputerized control group were extraordinarily good. They achieved a mean score at the first-grade 69th percentile level; that means those kindergarten children could read and write better than 69 percent of the students a year ahead of them in school. But the results among students under the *Writing To Read* program were even better—at the 89th percentile. Unofficial results from other schools indicate that after the first year of the program 63 percent of the kindergarten children could compose complete sentences and even stories. Usually at that age, a child may be able to write his name and a few other words. Among first-graders, 93 percent were writing.

What has made possible such extraordinary results is a combination of an idea and a tool. The idea came from Dr. John Henry Martin, a teacher, principal, and superintendent who retired to Florida in 1975. Martin had always been intrigued by the learning process—how a child encounters a new fact and assimilates that fact into the organization of knowledge he already carries around in his head. He believed educators generally were neglecting the importance of physical action in learning. The physical act of writing a word somehow embeds that word deeper in a child's brain than merely reading the word or even speaking it.

"It goes back to ancient times," Martin says. "The finger in the sand is the oldest writing instrument. But it wasn't until 1910 that a piece of Chinese technology became cheap enough to be used in school rooms. That was paper. Before then paper was too expensive to be used for practice. The slate and chalk became the symbol of the rural school, and reading ceased to be a handwriting exercise.

"By the 1920s, educators started talking about teaching reading in terms of whole words. Phonetic was out. For sixty years reading became an eyesight proposition," he adds. "Children were handcuffed when they came into the classroom."

The tool that was joined with Martin's idea came from IBM. Martin had been impressed by a book written by one of his mentors, Dr. Ben Wood. Wood's book recounted an experiment using typewriters in elementary school. Wood, who had also been a consultant to IBM founder Thomas J. Watson, set up the first meeting between IBM and Martin, who wanted to get hold of some IBM Selectric typewriters to test his theories.

One of those theories was that when a child is first learning handwriting, forming each one of those strange abstract designs can be such a laborious process that the child loses track of the word or thought he was trying to express. Martin hoped to make a quicker connection between the thought and the written expression of it by providing youngsters with typewriters. Then all that would be required to create a letter would be a quick stab at a keytop. The Selectric was important because it was the first typewriter that didn't have keys a child could jam.

In 1977 IBM loaned Martin sixteen Selectrics, and Martin began an experiment with 126 first-graders in the Martin County, Florida, school system. At the end of two years, preexperiment 44-percentile scores had been raised to the 82nd percentile. Satisfied with the results of the experiment, Martin set out to adapt an even better tool to his theories—the computer.

Martin hired programmers to convert his theories to computer software. Despite his agreement to work with IBM for the testing and eventual marketing of *Writing To Read*, Martin is still highly possessive of the program. "I own it. IBM has no right to change a word of it," he says.

Nevertheless, IBM is heavily committed to *Writing To Read*. At more than 100 schools IBM donated more than 300 Personal Computers and typewriters, 900 tape recorders, 2,410 sets of earphones, almost ten thousand floppy disks, 12,885 audiocassettes, 104,410 student workbooks, and 9,000 story books.

Officially, the program is not being marketed, but some one hundred twenty other schools that had heard of the test after it began approached IBM about joining the experiment. IBM sold them the equipment and program at a reduced rate, an IBM spokesman says. And although the program has not even been formally announced, unofficially IBM personnel speak proudly of it. The likelihood is that IBM will be offering it to schools as soon as the Educational Testing Service, as expected, verifies the unofficial reports of the achievements made by children in the pilot project. IBM has not yet determined a price for the software.

What schools would be buying, IBM spokesmen are saying, is not the type of education program that had been on the market previously—one that presented a simple drill exercise to reinforce the instruction presented by the teacher. Instead, the computer would become the primary instructor, with the teacher reinforcing what the computer teaches.

> "The computer is radio, movies, and television combined."

"There is tremendous variability among teachers—from the dull and unimaginative to the extraordinarily creative and warm," Martin explains. "Some of the methods of education have been subject to idiosyncratic uses. A computer can diminish that reliance on teacher variability."

Martin points out that Thomas Edison wrote in 1879 that the camera and motion picture projector would replace books. The same has been said about radio and television. Those prophecies have always been wrong, but Martin believes that the computer may fulfill its promise of being the ultimate provider of information and learning.

"The computer is movies, radio, and television combined," Martin says. "It's all of these audiovisual devices—plus the typewriter. And it is interactive if the software is so designed. Movies are not interactive; you react. Same with television and radio. But the keyboard of a computer is interactive. The learner is engaged in intellectual conversation with the computer."

At Houston's Pugh Elementary, that conversation is a quiet one. In fact, the first impression a visitor to the school's computer lab has is one of exceptional order and quietude for a room full of six-year-olds. The children are working separately and with a minimum of adult supervision on different stages of the reading program.

"Behavior problems disappear in here," says Adela Moore, the teacher in charge of the computer lab. "This is one class they don't want to miss. If they get to come here early, they get really excited. They like the hands-on activity, and using the typewriters and computers makes them feel grown up.

"At first," she adds, "it was just a video game to them. But now that they're more into it, it's a learning game. They're very competitive."

Like all the other kindergarten and first-grade classes at the school, these students from Linda Cesak's first-grade class visit the computer lab for forty-five minutes every day. (The only exceptions are classes where Spanish-speaking students are still learning spoken English. Pugh teachers, however, have been informally testing *Writing To Read* for teaching English as a second language—with some promising but inconclusive results.)

When the students arrive at the computer lab, Moore gives them their assignments. Each child proceeds at his or her own rate. Some kindergarten children finish the complete program of ten "cycles" in six months; others take two years. The children keep track of every step of the progress in a workbook, and each day they pick up where they left off the previous day.

Today, some of the children go to a bank of IBM Selectrics and audiocassette tape recorders. Some use the recorders to listen to stories as they follow along in books. Others slip used computer punch cards into the typewriter and follow the tape's instructions to type different words on the backs of the old cards. They type with one or two fingers, their eyes darting swiftly over the keyboard in search of the correct letters. The typing is reinforcement for the lessons they've been taught on the computers.

Eight IBM PCs are lined up on short, six-year-old-sized tables that wrap around two walls. Connected to the PCs are speech synthesizers that allow the computer to speak to the students, in a calm female voice, through two sets of headphones. One part of Martin's theory is that children will learn better in pairs because they can reinforce and help each other. Close to the end of the two-year experiment, however, the children in this class are now at such different stages of the program that most of them are working alone.

Aaron Phillips is one of those students. He is four feet of restless movements and shy grins topped by alert, dark eyes. He takes one of ten disks that make up the *Writing To Read* program and inserts it into the PC. (Before the program began, the students spent a week learning about computers and the care and handling of floppies.) With a hacker's assurance, Aaron hits control-alt-delete to reboot the machine. While the computer is cranking up, he slips on a pair of headphones.

The computer finally produces a title screen—"*Writing To Read*"—in bright, dancing colors. Next comes a menu that offers Aaron a choice of three word or two sentence exercises, one of them called "Silly Sentences." Over the headphone the woman's voice matches the instructions written on the screen by prompting Aaron to make a selection or press the space bar.

"Spelling was a concern for us, but it didn't concern the kids."

Aaron chooses "PIG." The computer announces that it is "THINKING" for several seconds, and then the color monitor displays a drawing of a pig, with the word "pig" spelled out next to it. The voice on the headphones says, "This is a pig. Say the word pig."

"Pig," Aaron says.

The drawing is replaced by the alphabet, displayed around the edge of the screen so that the letters leave a blank area stage-center on the screen.

"Pih," announces the voice on the headphones, and the lowercase letter *p* comes dancing out to the center of the screen. The voice sounds out the vowel sound in "pig"—ih—and the *i* prances over to take its place next to the *p*. "Guh," and the *g* joins them. "Pig," the voice says.

As the letters march back to their original positions, the lesson repeats itself, asking Aaron to speak the sound of each letter. Aaron, staring at the computer screen as if it were a Saturday morning cartoon show, repeats each sound. Then the voice tells Aaron to "type pih." Aaron scans the keyboard and jabs the P key, and the letter moves to center.

Later, Aaron is rewarded and at the same time given a sly lesson on sentences when he is presented an illustrated "silly sentence"—"Did you ever see a pig in bed?"

At times the program will ask Aaron to clap his hands or stamp his feet when he repeats a word. Martin's research has indicated that children remember things better when a physical action is involved, whether stamping feet or pushing a keytop.

"If you can engage a learner's eyes, ears, hands, and mouth, he'll learn better than if he only works with his eyes," Martin maintains.

If Aaron had pressed the wrong key, the voice would have simply repeated its instructions to "type pih." Martin feels that one of the advantages of a computer is that it is endlessly patient. In situations where a human teacher may become frustrated and let his or her impatience show to the student, the computer simply repeats instructions as often as necessary, always calmly and without a hint of disapproval. If Aaron had pressed the wrong keys too many times, the program would have determined that Aaron needed more practice. It would have looped him back to an earlier stage of the lesson without ever dropping a hint that he had just "flunked" a test.

Once he has successfully completed a lesson, Aaron moves on to other phases of the program—typing the words on a Selectric, writing letters by hand in a workbook, or listening to recordings of classic children's stories. All the other phases are designed to reinforce the session at the computer.

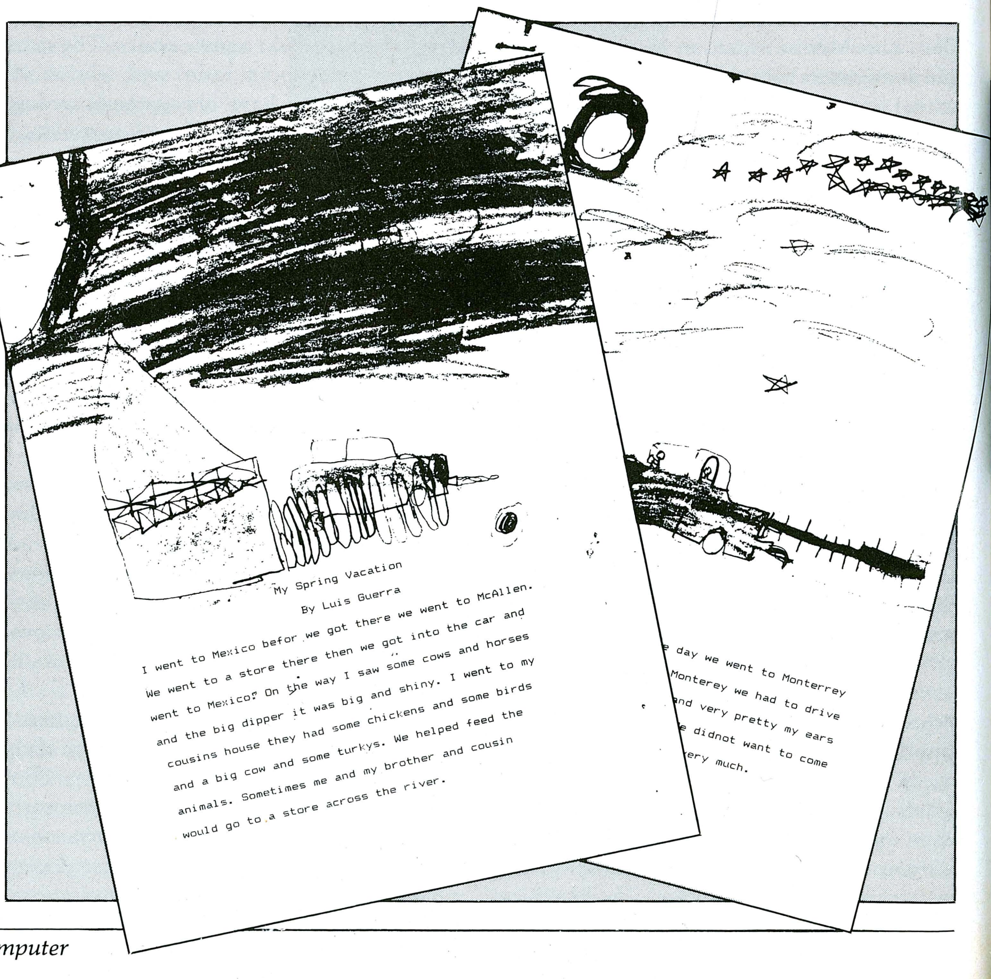
There are ten segments to *Writing To Read*, each of which teaches the child three words. A total of thirty words hardly seems impressive by itself. But the words are chosen in such a way that once a child has mastered them, he knows what Martin calls a "temporary standardized alphabet": the basic sounds of the twenty-six letters plus forty-two phonemes—such as sh, th, and ch. With the characters for these sounds, the child can write virtually any word he can think of, Martin says.

"A child comes to elementary school with a vocabulary somewhere in the mid-two-thousand range," he says. "Put that against the standard primers with only four hundred words for the student to work with and based on the false logic that they must control the child's vocabulary. We're unlocking children's full vocabulary. We're allowing them to write such wonderful words as 'furious' and 'refrigerator.'"

Of course, the children may wind up spelling these words "furius" or "refrigerater." That was one of the worries teachers at Pugh had when *Writing To Read* was introduced to them.

"Spelling was a concern for us, but it didn't concern the kids," says Emily Cole, principal of Pugh. "The teachers follow up with lessons on such things as the silent E. But generally the children just seem to pick up the correct spelling once they've seen the word in print."

Martin pointed out that *Writing To Read* presents each word as it is spelled correctly and



My Spring Vacation

By Luis Guerra

I went to Mexico befor we got there we went to McAllen.
We went to a store there then we got into the car and
went to Mexico? On the way I saw some cows and horses
and the big dipper it was big and shiny. I went to my
cousins house they had some chickens and some birds
and a big cow and some turkys. We helped feed the
animals. Sometimes me and my brother and cousin
would go to a store across the river.

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and very pretty my ears
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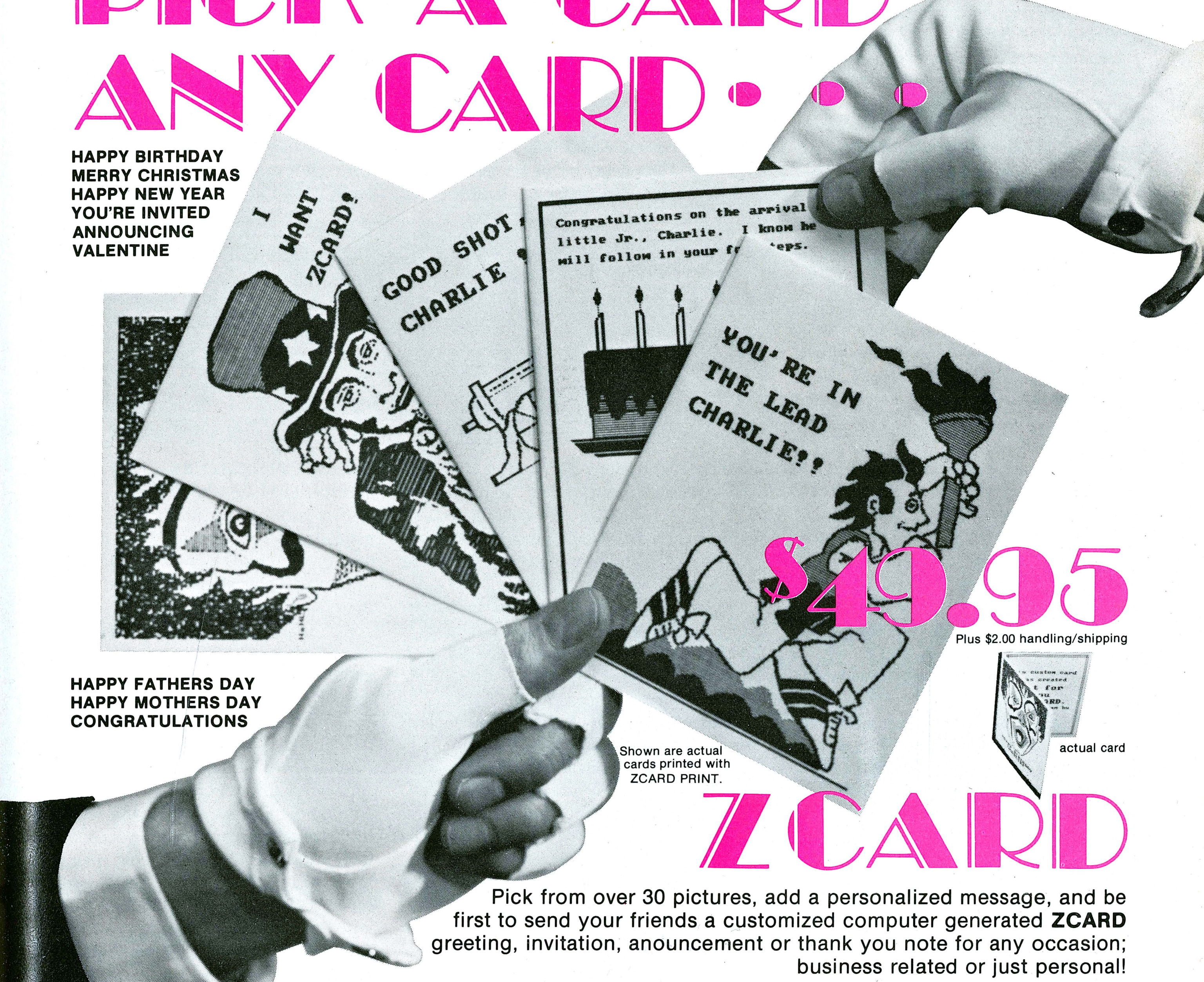
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as it is spelled phonetically. A picture of a rabbit, for example, is accompanied by the spellings "rabbit" and "rabit."

But correct spelling has simply never been a concern of Martin's. In a manner that brims with cavalier calculation, he dismisses entirely the necessity for spelling words correctly from the outset. He would prefer that children—and adults—not be bothered with it.

"The phonetic analysis of English spelling is a terribly confusing process, even if it works," he says.

It's a problem that may nag us as adults anytime we start to write a word that we often use only in speech. We may write the word so infrequently that we're not at all sure how it's spelled. Such encounters send us scurrying to the dictionary or, Martin says, simply lead us to substitute another word—maybe not a word with exactly the meaning we wanted but one we can spell.

"What we really have to do is teach a whole adult generation that they don't know how to write," Martin says. "When they're writing, they're only writing the first draft. The process of writing is called rewriting. The finest piece of political literature by the greatest political stylist is called The Declaration of Independence, and it went through seventeen drafts before Jefferson felt it was good enough to show to Franklin and Adams. And they rewrote it some more.

"We've got to get rid of this notion that a child's first draft should be neat and clean so they can put it on the wall with a doily for parents' night. This premature insistence that you have to be able to spell the best words in your vocabulary is one of the great inhibitors of adults. You should just write it the way it sounds until you see it in a book.

"We let the children in on the secret from day one that the way the word is spelled in a book is what they're going to get to eventually. They don't have a problem with that," he adds. "Almost never does the single most common word in the English language get spelled 'thu,' although that's the way it sounds. The children see it as 'the' in books and they pick it up with no problems."

Still, a computer program openly embracing misspelled words is not one likely to offer immediate appeal to most elementary school teachers. The teachers in the Houston School District are on better terms with computer technology than teachers in many other cities. The school district has a technology department staffed by seventy people whose task is to evaluate requests for classroom computers, distribute the equipment, and eventually make every teacher in the district computer-literate. The department even has programmers who are writing the district's own word processing, financial, and English-as-a-second-language software. And before the arrival of the IBMs, Pugh already had several Apple and Radio Shack computers that had been bought partially with money raised at food sales.

Even with this familiarity with classroom computers, the teachers at Pugh did not embrace *Writing To Read* fully until the end of the first year.

"Everyone was skeptical at first," says Bill McCauslen, a member of the school district's technology department who has been keeping a watch over *Writing To Read* at the three schools where it's being tested. "Some teachers were really hostile to it, especially the second-grade teachers who would get the children after the program and would have to correct all the mistakes."

"Almost every child this year can write something. I'll never cease to be amazed at it."

So serious were the doubts among the faculty at Pugh that for the first few months after the experiment began, the teachers met with principal Cole once a week to decide if they would continue it.

"When we first saw the program, we were leery of it," Cole says. "There were too many things that were innovative thoughts. There was a real controversy among the staff over it. We didn't mind if the program just turned out to be ineffective, because the children would be getting the same material in other ways. But we didn't want to do something that might hurt the children's progress."

But as computer teacher Moore says, "It worked in spite of us." Cole says the school will continue to monitor the students after they've left the program to see what lasting effects the program may have, but she is convinced that *Writing To Read* gets results in teaching both reading and writing.

"It's an excellent program. When a child is completing a cycle, you can see a light dawning," she says.

Cole wants to continue the program after the test period ends this summer, and IBM has agreed to let the equipment stay there for at least another year.

"If IBM didn't offer it, I'd buy it," she says.

Praise for *Writing To Read* also comes from the teachers who are on the front lines. Mattie Jo Thrasher has been a kindergarten teacher for fifteen years. She admits to having had qualms about the program until she saw the results.

"I've never had children who wrote before. Occasionally one could write a few words. But almost every child this year can write something. I'll never cease to be amazed at it.

"It's really more work for the teachers; there's a lot more to keep track of," she adds. "But the computer explains things so well, it's worth it."

Dianne Punch was one of those second-grade teachers who feared they might be inheriting the problems of a poorly conceived experiment. But now she reports that the second-graders who went through the first year of the experiment are reading books that are one to two years above their grade, are writing more than second-graders she has taught in the past, and are showing no signs of being poor spellers. Her only complaint is that *Writing To Read* doesn't go far enough.

"It underestimated itself," Punch says. "Some of the children mastered it in six months. They spent lessons one through five learning words but not knowing what's going on. Then suddenly it all came together and they zoomed through the rest of the cycles. And they were bored after that."

(Martin, told of Punch's complaint, pointed out that the average child should get through the program's ten cycles in about six months. Only the slower children would require two years, he said, adding that there are plans to expand *Writing To Read* into more advanced lessons. There are also plans to make the program available for the PC*jr*, which will make it more affordable.)

The one person not at all surprised by all this is, of course, Martin himself. As some unofficial results of the experiment were coming in toward the end of last semester, Martin was beaming at the scores as proof of his theories and those of other educators that he built on.

"Montessori in 1910 in Rome found it imperative to teach children's minds through their fingertips. She used sandpaper letters for the tactile, kinesthetic stimulation," he says. "The Spaldings, a husband-and-wife team, wrote *The Writing Road to Reading.* Piaget worked in Paris to organize information in a logical pattern that a child can learn better.

"My work is derivative from the whole historical pattern," he says. "These findings are a confirmation of the earlier efforts."

But later, in a less modest moment, Martin couldn't resist adding: "And it's the best unannounced product IBM has in its system." ▲

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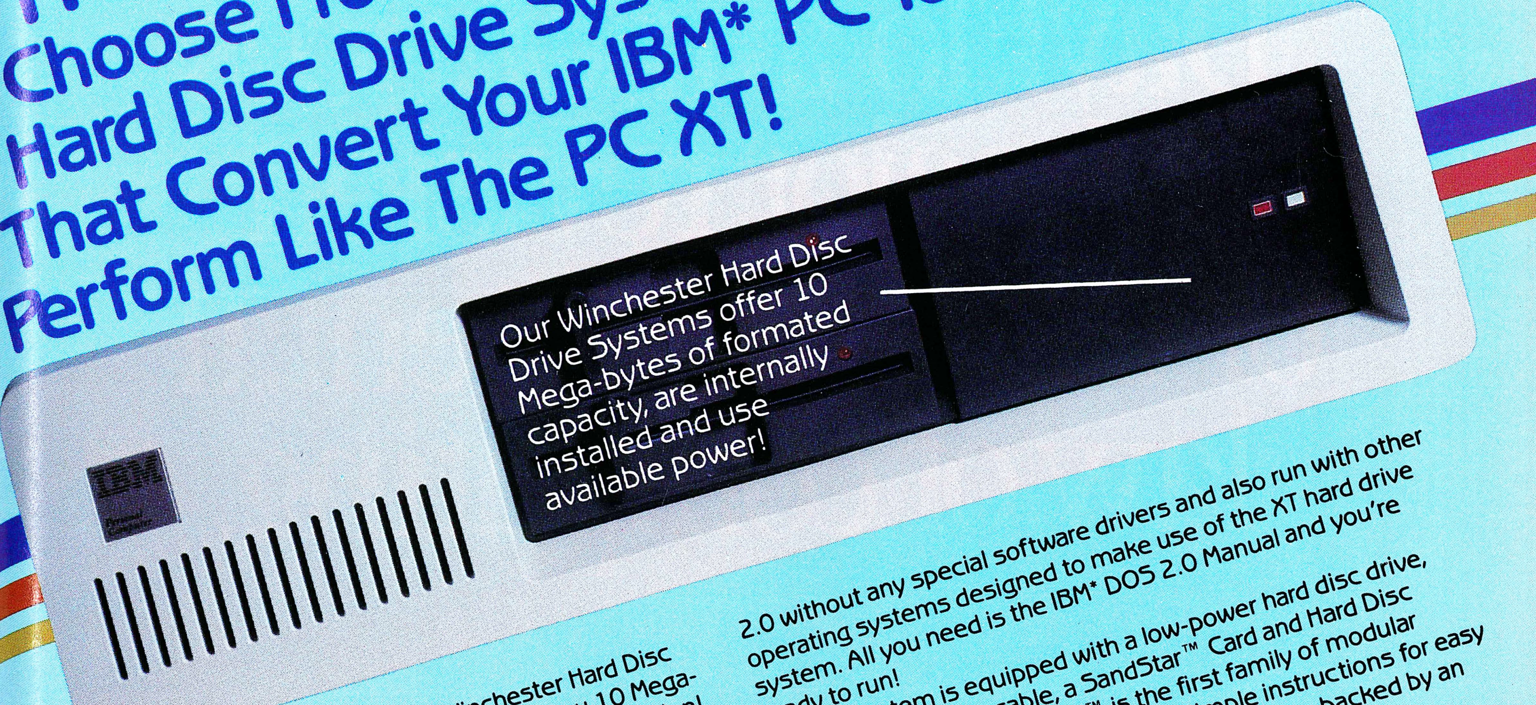

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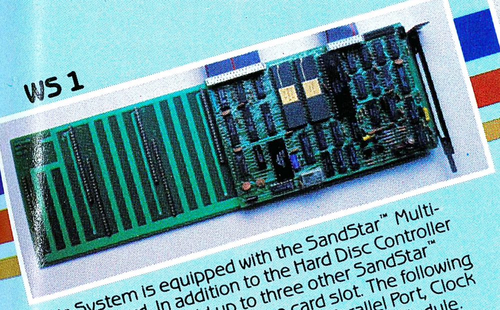

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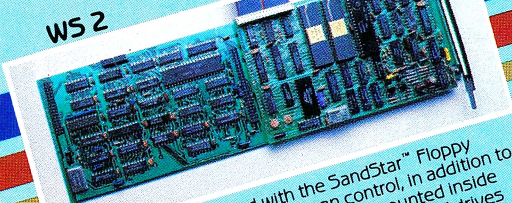

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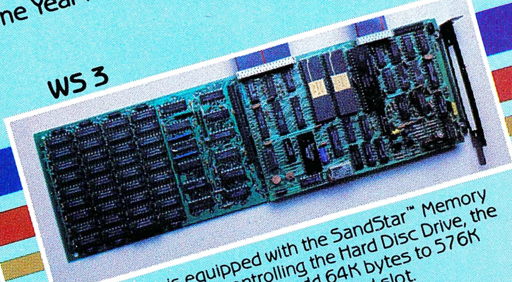

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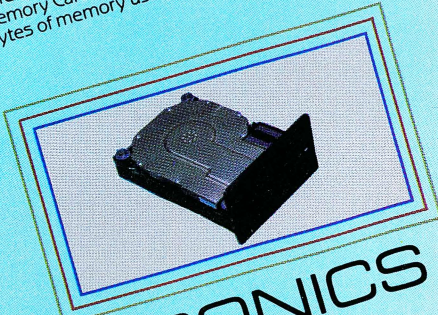

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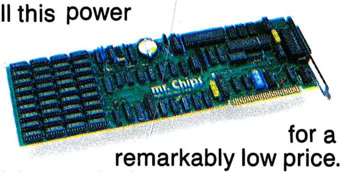

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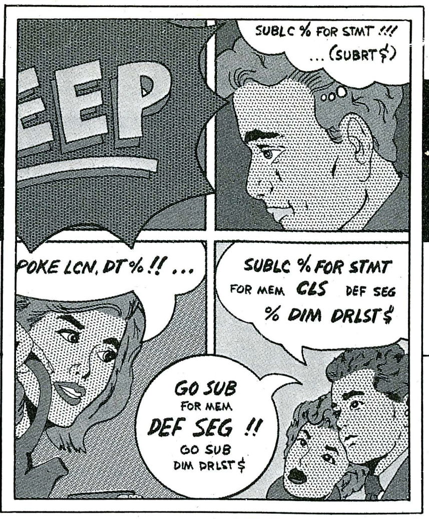
EEP
SUBLC % FOR STMT !!! ... (SUBRT$)
POKE LCN, DT% !! ...
SUBLC % FOR STMT FOR MEM CLS DEF SEG % DIM DRLST$
GO SUB FOR MEM DEF SEG !! GO SUB DIM DRLST$

BASICALLY SPEAKING

by John Dickinson

Basic Car Care

Probably the best part about learning to write your own Basic programs is that you can do useful things with programs of your own that you couldn't readily do with prewritten or store bought ones.

For example, let's suppose your car breaks down once too often and you buy a new one. Most people think about car performance and maintenance when their cars are brand-new; as a car gets older the tendency is to take it for granted, even though it needs more attention than it did when it was new.

Wouldn't it be nice to have a computer program to help you track your car's performance and to remind you when regular maintenance is required? By monitoring the car's performance, such a program could also tell you when your car needed special attention. You won't find any such program on the shelves at your computer store—so let's write our own, in Basic.

This month we'll start out by creating a program that just tracks a car's gas mileage and rates its performance in that area. Later, we'll add features to the program so it can help with maintenance scheduling, track repairs and costs, and compute the overall operating cost per mile.

As we develop the program you'll learn quite a few new things about Basic, including how to use relational operators and *if* statements, ways to organize and maintain a program's data, tricks for controlling display formats and manipulating the display screen, tips on using your printer, and how to reorganize a Basic program as your ideas develop.

There are many ways to design a computer program. The easiest is to start by writing a piece of code that handles a small aspect of the problem at hand and then make changes to it later on as you see ways to enhance its function and add new features. Because Basic's working environment is interactive, it's fairly easy to change a program around as you develop it; but even though it's easy, you can still make mistakes. It's usually simple enough to recover from an error, but it's a good idea nevertheless to make a backup copy of your working Basic disk from time to time; that way you're sure to be able to recover if you make a serious mistake while changing your program.

The simplest thing our program has to do is compute a car's gas mileage. The calculation itself is easy:

Gas mileage = miles driven / gallons used

Everyone knows the formula, and many of you have been keeping track of your car's mileage as the cost of gasoline (and diesel fuel) has made fuel consumption a matter of increasing concern. All you've had to do is note the odometer mileage and gallons of fuel loaded at each fill-up, and then do this calculation:

Gas mileage = (new odometer miles − old odometer miles) / gallons loaded

It would be simple enough to get Basic to compute this formula in immediate mode for any tankful of gas (be sure to note the parentheses if you try it), but let's start developing our new program in Basic's deferred mode. Since we're going to be adding to the program and changing it quite a bit (which means running it several times as well), there's no sense in having to type the whole thing in again every time. Besides, you can learn something new.

Start Basic as you normally do, and type:

```
auto
```

You'll see:

```
10 _
```

appear on your screen. You are now in the Basic editor's *automatic input mode*, and the cursor's position indicates that Basic is set to accept input for your first program statement on line 10. In automatic input mode, Basic automatically generates line numbers for you to use

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in your program; it continues doing so until you exit from automatic mode by typing the control-break key combination. For example, if you type:

```
10 let old.odometer! = 0 [Enter]
```

line 20 will appear automatically, ready for you to enter another statement:

```
20 _
```

The line your cursor is on when you leave automatic input mode is not saved in memory, so be sure you've entered the last program statement you want saved before you type control-break.

Automatic input mode normally starts with line 10 and increments each new line number by 10, but you can tell it to start on a different line and use a different increment. The more general format of the *auto* command is:

```
auto {starting line}, {increment}
```

For example, to start automatic input mode on line 100 with an increment of 5, you would type:

```
auto 100,5
```

Automatic input mode can be used to add new lines to a program or to replace existing lines—as well as starting a new program. If you use automatic input mode to replace lines, any line generated that already contains a BASIC statement will be marked with an asterisk, like this:

```
20* _
```

If you just press the enter key when an asterisk is shown, the original statement on the "asterisked" line won't be changed.

Continue using automatic input mode as you finish entering our first attempt at the Car Care program. When you're done and have exited from automatic input mode, your screen should look like this (remember, you can type in upper or lower case; we're showing upper case here just to make it easier for you to check your listing):

```
auto
10 LET OLD.ODOMETER! = 0
20 LET NEW.ODOMETER! = 239
30 LET GALLONS.LOADED! = 18.3
40 LET MILES.DRIVEN! = NEW.ODOMETER! —
   OLD.ODOMETER!
50 LET GAS.MILEAGE! = MILES.DRIVEN! /
   GALLONS.LOADED!
60 PRINT GAS.MILEAGE!
70 _ [Ctrl][Break]
Ok
```

You won't see anything displayed when you press control-break; we printed it just to be sure you didn't type it in until you were on line 70.

You might want to stop for a moment to look at the variables and constants in the program and see how they're used. All the variables are single-precision real numbers (note the "!" suffix on each name), and constants are assigned to three of them in the first three *let* statements. These constants, which represent our new car's first fill-up, are the data we'll start with. The next two lines contain *let* statements that do the calculation for Miles.driven! and Gas.mileage!, and the last line displays the results for Gas.mileage! on the screen. When you run the program (remember, you can use the F2 key as a substitute for typing *run*, if you wish), your screen will display

```
13.06011
```

which is the program's calculated Gas.mileage! for our new car's first tankful.

That's not great mileage, but it's the first tankful in a new car, and, as those of you who have kept track for your own cars know, one tank of gas alone does not give a reliable indication of a car's gas mileage. The easiest way to better determine our gas mileage is to see how many miles we get from our next tankful.

To do that, we'll just change lines 10, 20, and 30 to enter the data for our next fill-up. You'll notice that the new data assigned to Old.odometer! is the value that was previously used for New.odometer! (this information will come in handy later on). Try to remember to use all of the BASIC editing tricks you learned last month as you make these changes:

```
10 LET OLD.ODOMETER! = 239
20 LET NEW.ODOMETER! = 537
30 LET GALLONS.LOADED! = 18.2
```

You can substitute data for your own car if you want, but it might be better to use these numbers for a while, just to be sure you've got everything right. Running the program this time produces:

```
16.37363
```

Better mileage for this second tankful, but we still don't have enough information to tell us just how well (or poorly) we're doing.

One thing we could do is compare our car's gas mileage against some standard that it ought to be meeting. Figuring out a standard for gas mileage on new cars is easy because the expected mileage is printed on the price and information stickers. If you have an older car, you can use some figure for gas mileage that you think the car ought to be getting; later on, we'll be able to use our BASIC program to help us determine what a car's standard gas mileage ought to be.

Let's say the sticker on our new car indicates we should expect about 15.5 miles per gallon in combined city and highway driving. We'll use that figure as a standard in our program. How do we use this information in BASIC? If we think about the gas mileage problem in logical terms (never mind BASIC syntax for a moment), we might state it this way:

```
IF gas mileage is equal to 15.5 THEN performance is equal to
standard
  ELSE performance is not equal to standard
```

Can BASIC handle this kind of problem? Sure. Here's one simple way. Add the following line to your program:

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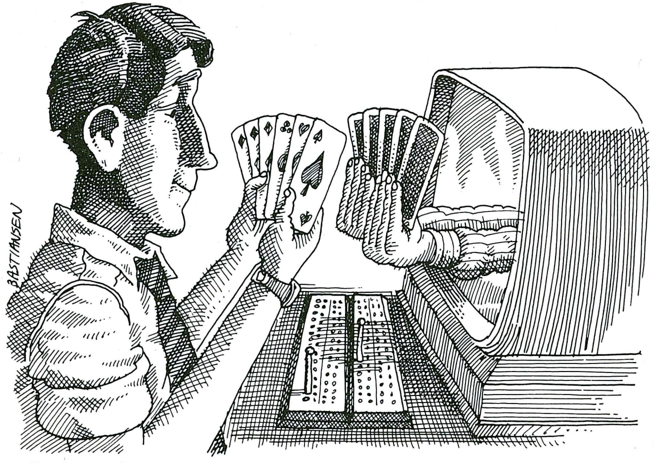

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```
70 IF GAS.MILEAGE! = 15.5 THEN PRINT "Performance is
    standard"
      ELSE PRINT "Performance is not standard"
```

As you type this new line in, you might notice that when you reach the right-hand edge of the screen BASIC just keeps going on the next line, starting at the left edge (readers with forty-character screens may already have noticed this phenomenon). This is perfectly all right; BASIC can handle statements as long as 255 characters, which is a little more then three eighty-character lines.

If you want to make things a bit neater, you can either add spaces (BASIC doesn't mind spaces between commands, operators, variables, or constants—just don't use them in the middle of a variable name!), or you can start a new display line at any point by typing control-enter. If you do this, the new display line you type will be part of the same BASIC statement (it will be part of the same-numbered BASIC program line), and BASIC will automatically insert enough spaces for you to keep things neat. To tidy up line 70, you might type:

```
70 IF GAS.MILEAGE! = 15.5 THEN PRINT "Performance is
    standard"[Ctrl][Enter]
      ELSE PRINT "Performance is not standard"
```

When you run the program with this new line added you will see:

```
16.37363
Performance is not standard
```

on the screen. What's the new statement all about? It's a BASIC *if* statement that's used to check the relationship between the variable, Gas.mileage!, and the constant, 15.5 (our standard value). The first part of the statement,

```
IF GAS.MILEAGE! = 15.5
```

asks the question, "Is Gas.mileage! equal to 15.5?" The way the question is stated, the answer can be only affirmative (true) or negative (false). There are two more parts of the *if* statement. The *then* clause

```
THEN PRINT "Performance is standard"
```

tells BASIC what to do if the answer is affirmative. The *else* clause

```
ELSE PRINT "Performance is not standard"
```

tells BASIC what to do if the answer is negative.

Notice that both the *then* and *else* clauses use familiar-looking *print* statements. Each statement, without the *then* or *else*, could stand by itself as a BASIC statement. It is not necessary to use *print* statements in these clauses. Almost any valid BASIC statement can be used instead of a *print* statement. We'll see some examples shortly.

The *else* clause is optional. BASIC will be satisfied as long as there is an action to take (in the form of a valid BASIC statement) if the relationship you're checking for holds true; so all that's required is the *then* clause. It's a good thing that BASIC doesn't require the *else* clause, because you may not care to have anything done if the relationship doesn't hold true. When you do use an *else* clause, the action it specifies must be a valid BASIC statement.

The *if* statement uses the familiar equal sign as a BASIC *relational operator*. By now you've become used to seeing this symbol used as an *assignment* operator in *let* statements, but don't worry about getting confused; relational operators are almost always used in the first part of *if* statements, and you can be pretty sure that the equal sign is not an assignment operator if you see it in that position (it's almost surely an assignment operator if it's used in a *let* statement that's part of a *then* or *else* clause).

Equality is not the only relationship that can be tested for in a BASIC *if* statement. The entire list of BASIC relational operators, and the relationships they check for, is:

Relational Operator	Relationship
=	equal to
>	greater than
<	less than
<>	not equal to
>=	greater than or equal to
<=	less than or equal to

Most of the relational operators use familiar-looking symbols that come straight out of a geometry or trigonometry textbook, but the last three may look unfamiliar; these are made up of combinations of the other symbols, and the symbol combinations reflect the relationships they are used to check for. For any of these last three operators, you can type the symbols in either order (in other words, <> and >< are equivalent, as are >= and =>, and <= and =<). All of the relational operators will get plenty of use as we move along, so you'll have little trouble getting comfortable with them.

We might as well start using more of them now. In this case, just knowing whether the car's gas mileage is at standard or not at standard isn't enough—we'd also like to know if the mileage is above or below standard; some of the other relational operators will help us get this information.

Add the following statements to the program:

```
80 IF GAS.MILEAGE! > 15.5 THEN PRINT "Performance is
    above standard"
90 IF GAS.MILEAGE! < 15.5 THEN PRINT "Performance is
    below standard"
```

Notice that here we don't use the optional *else* clause; you'll see in a moment why we don't.

When you run the program now,

```
16.37363
Performance is not standard
Performance is above standard
```

appears on your screen. The gas mileage is not equal to standard because it's above standard, and this is duly reported by the program. If you go back and enter the data for our original tankful into lines 10, 20,

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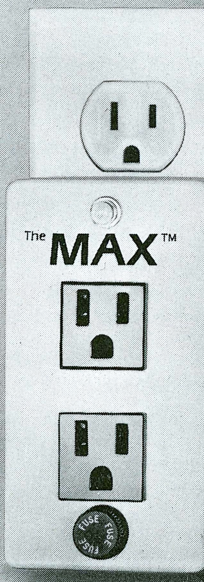

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and 30, and rerun the program, you'll see:

```
13.06011
Performance is not standard
Performance is below standard
```

on your screen. Try using the following data in order to get the "Performance is standard" message to be displayed:

```
10 LET OLD.ODOMETER! = 0
20 LET NEW.ODOMETER! = 248
30 LET GALLONS.LOADED = 16
```

Now let's take a closer look at the three *if* statements we have in our program:

```
70 IF GAS.MILEAGE! = 15.5 THEN PRINT "Performance is
   standard"
     ELSE PRINT "Performance is not standard"
80 IF GAS.MILEAGE! > 15.5 THEN PRINT "Performance is
   above standard"
90 IF GAS.MILEAGE! < 15.5 THEN PRINT "Performance is
   below standard"
```

We seem to be checking for three mutually exclusive conditions. If Gas.mileage! is equal to 15.5, then it's certainly not greater than or less than 15.5. If it's greater than 15.5, it isn't less, and if it's less than 15.5, it's not greater! This explains why we get two messages displayed whenever the mileage is not equal to 15.5

What can we do about the redundant message? One simple thing we might try is to combine lines 80 and 90 into a single *if* statement, like this:

```
80 IF GAS.MILEAGE! > 15.5 THEN PRINT "Performance is
   above standard"
     ELSE PRINT "Performance is below standard"
```

This puts two mutually exclusive conditions into one *if* statement; the new statement takes some action based on whether Gas.mileage! is greater than 15.5 or less. Now, eliminate line 90 by typing:

```
delete 90
```

or just

```
90
```

If you are using data that yield a value for Gas.mileage! that's either above or below 15.5, this combination of lines 80 and 90 will apparently work fine. But if you use data that yield Gas.mileage! of exactly 15.5, you'll see a mistake in the program. Try it for yourself and see if you can figure out what the problem is.

Even without the mistake, we still get two messages whenever Gas.mileage! is not exactly equal to 15.5, so we need to do something about that. An *if* statement's *then* and *else* clauses can contain (almost) any sort of BASIC statement. One type of BASIC statement that can be contained in a *then* or *else* clause is another *if* statement. That means that we can combine the two remaining statements (70 and 80) into one. Try this mouthful:

```
70 IF GAS.MILEAGE! = 15.5 THEN PRINT "Performance is
   standard"
     ELSE IF GAS.MILEAGE! > 15.5 THEN PRINT
      "Performance is above standard"
     ELSE PRINT "Performance is below standard"
```

Look carefully, and you'll recognize each of the pieces as having been part of one of the original *if* statements. All we've done is combine the parts into a single complex *if* statement that prints one message if Gas.mileage! is equal to 15.5, a different message if it's above 15.5, and a third message if it's below 15.5.

After you make this change, eliminate line 80, just as you got rid of line 90 before, and then run the program again. This time the results will be a little different; you'll get either the "Performance is standard" message or one of the other two messages. You'll no longer see two messages displayed on your screen when Gas.mileage! isn't exactly 15.5, nor will our mystery bug be present (did you find that bug?).

For all of our effort so far, all we have is a program that checks the car's mileage on a single tank of gas. What about all that repetitive power of a computer that we learned about before? How can we get the program to repeat itself and compute gas mileage for more than a single tank?

In the April installment of this series, you learned how to use BASIC *for* loops to make the computer do repetitive calculations. All we needed to do in our April example was compute values for formulas that required regularly changing variables, and a *for* loop worked fine there because we were able to use the loop counter as a variable in our *let* statements. But it's safe to assume that every time we fill the tank we'll get a different amount of fuel and will have traveled a different number of miles. How can a *for* loop help us in this situation?

We can't use the regularly changing value of a loop counter directly, but we can use a *for* loop to help us load data from outside sources into BASIC variables. How does that work? Well, BASIC can get data from a number of sources—including your keyboard, disk drives, tape drives and a modem connected to another computer by telephone. The *for* loop can be used just to repeat—a specified number of times—the operation of loading data into the program and doing calculations upon that data.

One way BASIC can read data is by using two special program statements—*data* statements and *read* statements. Any number of *data* and *read* statements may be used in a program and, within reason, these statements enable a BASIC program to use any amount of data it needs in order to operate. Each *data* statement can contain one or more values to be *read* into BASIC variables. Each *read* statement can *read* one or more of the values contained in a *data* statement and assign them to BASIC variables. The kind of value held in a *data* statement (numeric or character) depends on the type of variable into which we *read* it.

While *data* statements can contain any number of values, it's a good

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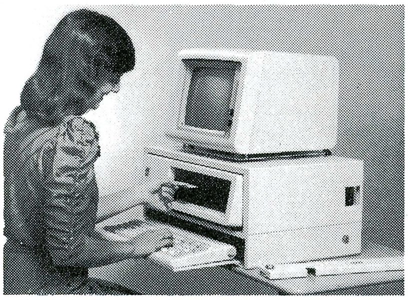

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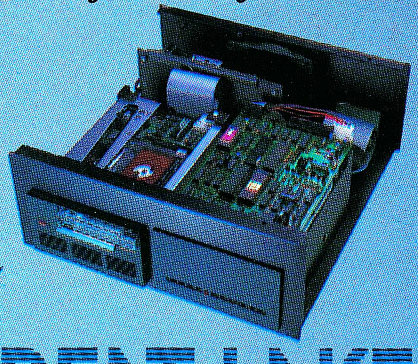

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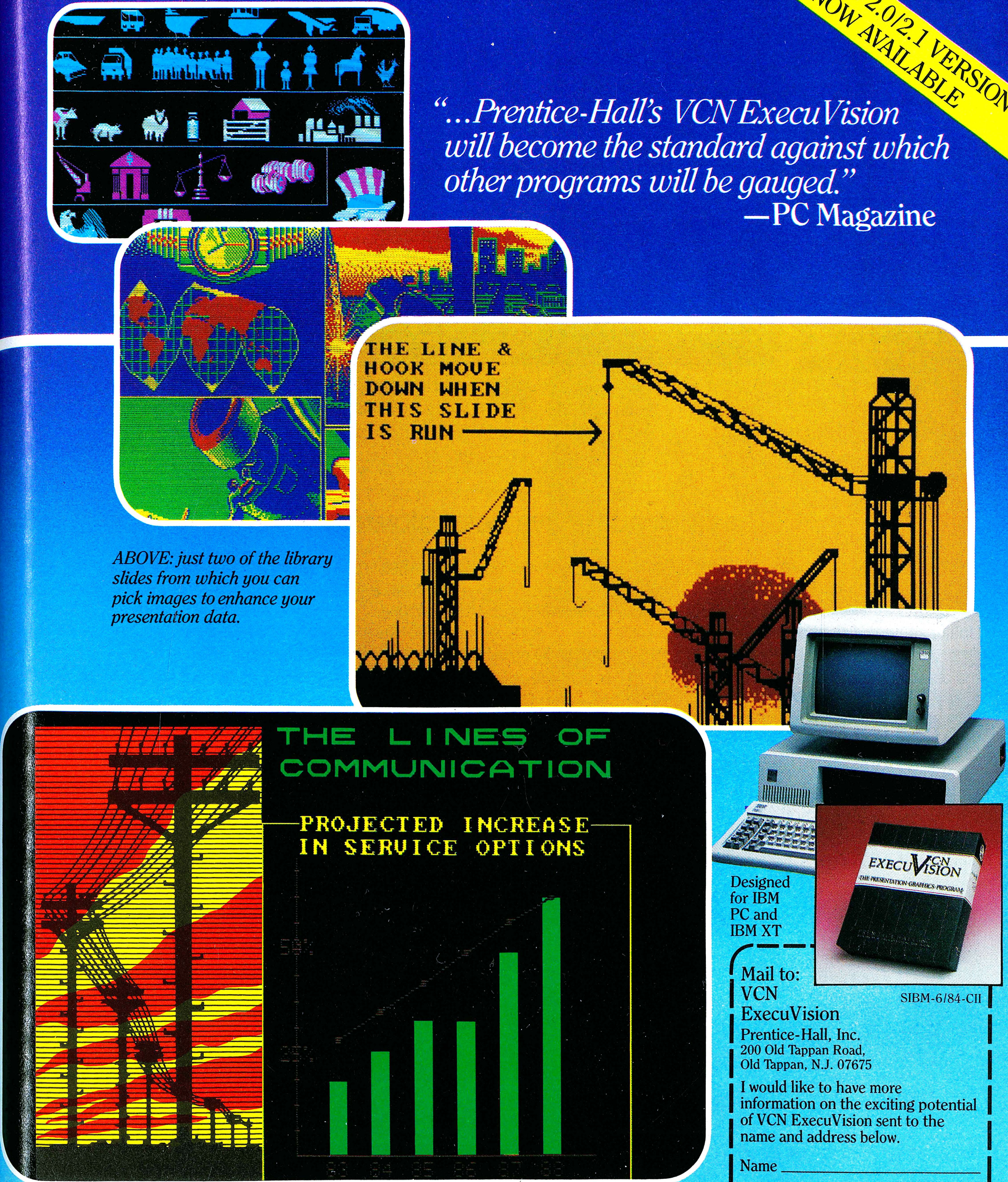

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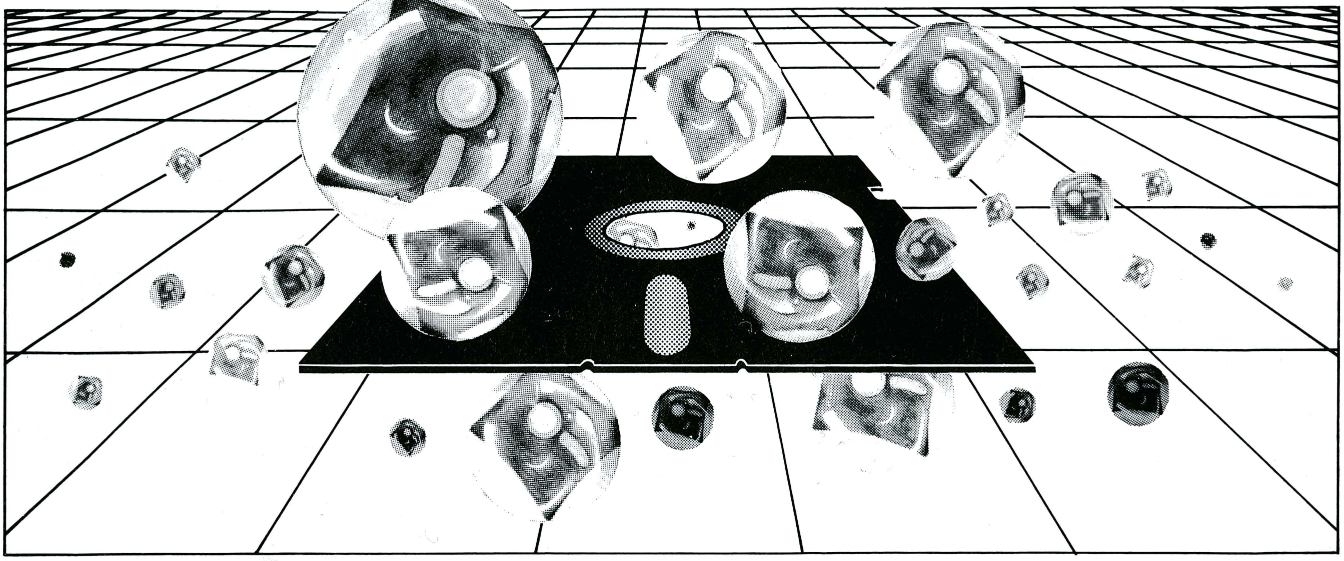

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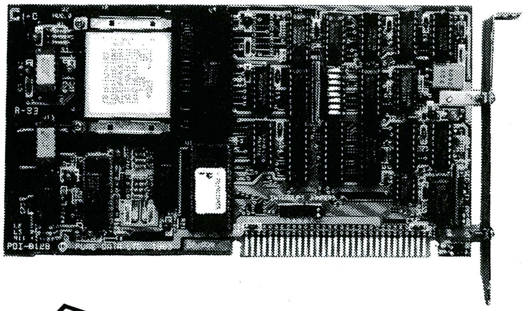

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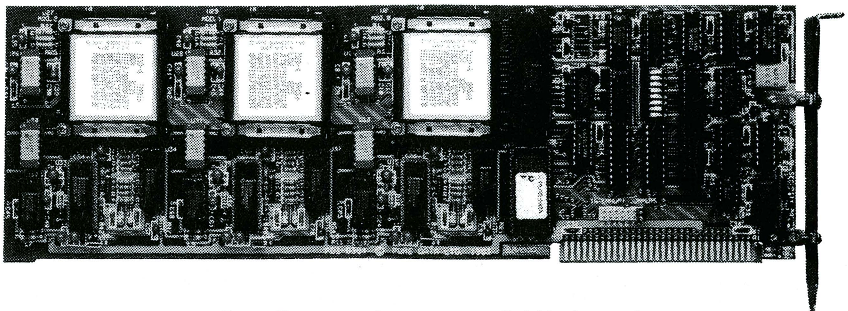

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idea to set them up so that they contain only as much data as needed for each repetition of the calculation or set of calculations. In our Car Care program, for example, we'll construct each *data* statement so it contains only the odometer reading and the gallons of fuel loaded at each fill-up.

What does a *data* statement look like? Let's find out by means of an example. Enter this statement into your program:

```
5 DATA 239, 18.3
```

You'll probably recognize that the first number in this statement (the first data item, not the line number) is the odometer reading for our first tankful and the second is the number of gallons of gas we loaded. In the very first version of this program, remember, we plugged these two numbers directly into the variables New.odometer! and Gas.loaded!, in lines 20 and 30 respectively. Notice that the *data* statement contains the word "data" followed by the two numbers and that the two numbers are separated by a comma. If there is only one value in a *data* statement, no comma is needed; if you put more than two values in the same *data* statement, a comma must follow each item except the last.

We've put this first *data* statement on line 5. It could go anywhere, but it's traditional for *data* statements to appear at either the beginning or end of a BASIC program. We've chosen the beginning. List the program to verify that, just by using the line number 5, we've inserted the statement at the top of the program.

We can easily add a second *data* statement containing the mileage and fuel data for our second tank of gas:

```
6 DATA 537, 18.2
```

We have enough information now in our two *data* statements to let us analyze the gas mileage from two tanks of gas, but if we run the program, nothing will have changed; we haven't yet added anything that tells BASIC how to use our *data* statements, so BASIC will just ignore them.

What we need now are some *read* statements. *Read* statements tell BASIC to get values from our *data* statements and assign those values to the appropriate variables. Because they have the effect of assigning values to variables, we can use *read* statements to replace the assignment (*let*) statements we used earlier.

To make the changes, start by eliminating line 10 (by typing *delete 10* or just *10*). Then, replace lines 20 and 30 with the following:

```
20 READ NEW.ODOMETER!
30 READ GALLONS.LOADED!
```

Each *read* statement *reads* as many numbers from *data* statements as you specify. Each of the two statements above asks BASIC to read one number and assign it to a variable. Because there are two values on each *data* statement, the effect of the two *read* statements will be to "use up" only one of the *data* statements; the second *data* statement will—for the time being, anyway—remain unread (we'll see in a moment how to use this second *data* statement).

You have to be careful to make sure your program reads all the *data* statements you want it to. You also have to be sure to provide as much data in *data* statements as you have told your program to read. If you ask BASIC to read more data than you're willing to provide, you'll be rewarded with an

```
Out of DATA in XX
```

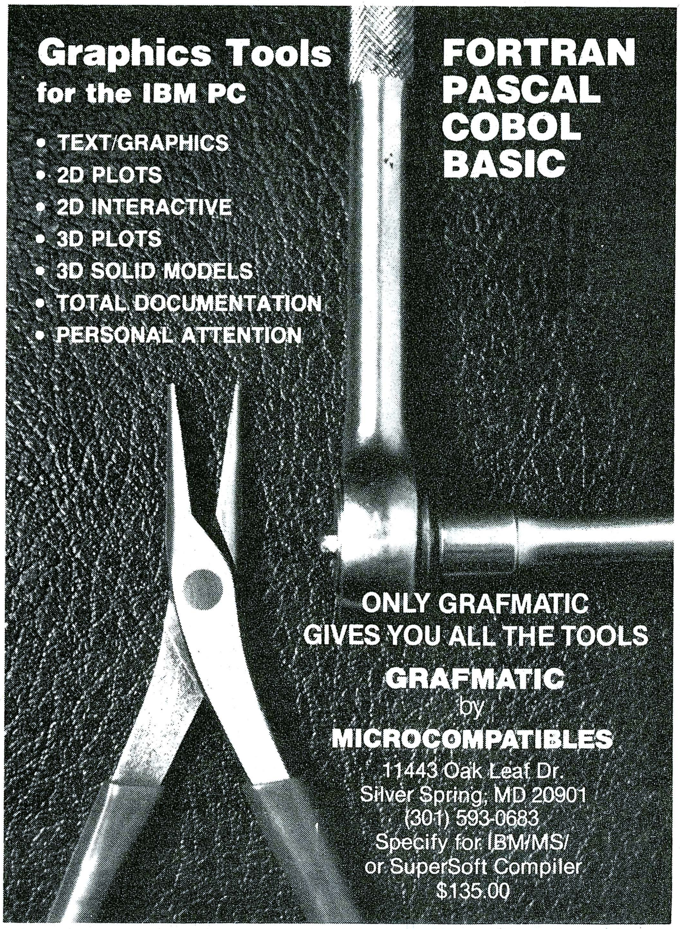
error message (XX will be the line number containing the *read* statement that found nothing to read).

If you run the Car Care program now, you'll get the same results as you did before (for the first tankful):

```
13.06011
Performance is below standard
```

Run it a second time, and you'll get exactly the same result—BASIC will just keep reading the first *data* statement over and over again each time you run the program. How do we get it to read the second one? With a *for* loop, that's how.

Installing a *for* loop in the program will take a little bit of work, but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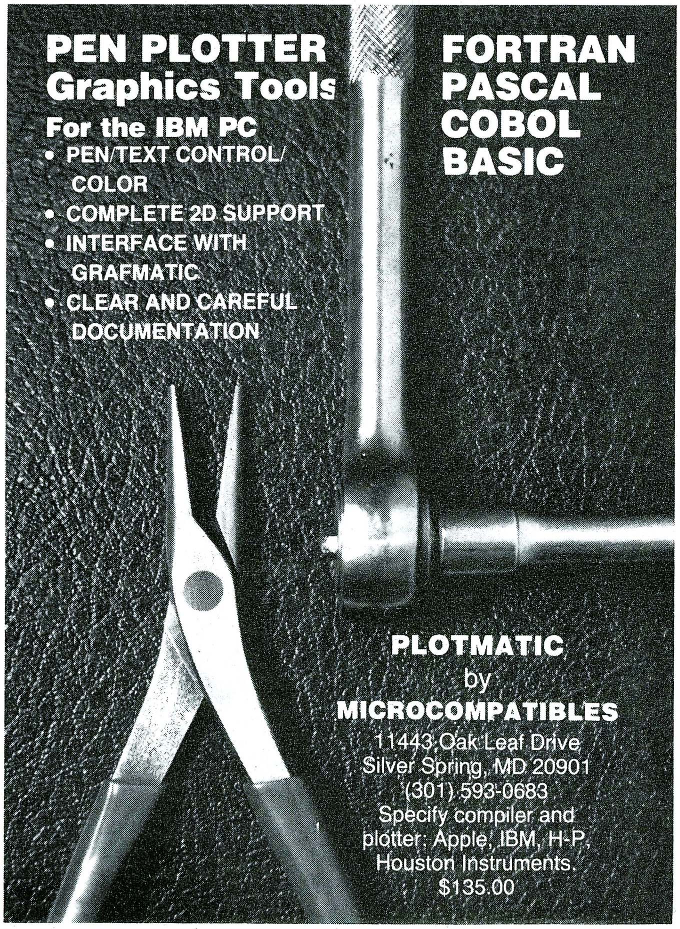
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it's nothing you haven't done already in other programs (we'll just do it a different way). Reinstate line 10 as follows:

```
10 FOR FILLUPS% = 1 TO 2
```

and add line 90:

```
90 NEXT FILLUPS%
```

The statement on line 10 tells Basic to start a *for* loop using Fillups% as a loop counter; line 90 is the companion *next* statement that ends the loop. Notice that our loop counter is an integer variable as a loop counter; that's because Basic programs run somewhat faster when integers are used as loop counters.

When you run the program this time you should see:

```
13.06011
Performance is below standard
29.50549
Performance is above standard
```

The *data* statements have been read for both fill-ups, and for each tankful the gas mileage has been calculated and rated against our standard.

But there's still something amiss. The second value for Gas.mileage! is ridiculously high (at least for *this* V-8 family bus).

What's wrong is that Old.odometer!, which we had previously set by means of assignment statements, is still at 0. Remember, Basic clears all variables to 0 whenever a program is started; if we don't do anything to change its value, Old.odometer! will remain at 0. To fix things up, we have to assign Old.odometer! the value that New.odometer! has when we're done with that value for New.odometer!. This is just what we did earlier in this article when we modified the program to work for the second tank of gas.

The best place to make this change is just before the *next* statement, when our program is just about to go back and read the data for the next fill-up. Add line 80 to make your whole program look like this:

```
5 DATA 239, 18.3
6 DATA 537, 18.2
10 FOR FILLUPS% = 1 TO 2
20 READ NEW.ODOMETER!
30 READ GALLONS.LOADED!
40 LET MILES.DRIVEN! = NEW. ODOMETER! —
   OLD.ODOMETER!
50 LET GAS.MILEAGE! = MILES.DRIVEN! /
   GALLONS.LOADED!
60 PRINT GAS.MILEAGE!
70 IF GAS.MILEAGE! = 15.5 THEN PRINT "Performance is
   standard"
     ELSE IF GAS.MILEAGE! > 15.5 THEN PRINT
   "Performance is above standard"
     ELSE PRINT "Performance is below standard"
80 LET OLD.ODOMETER! = NEW ODOMETER!
90 NEXT FILLUPS%
```

When you run this version of the program, you'll finally have correct results—along with the satisfaction of seeing your program begin to do some really useful work.

Next time we'll begin to make the program's output a bit neater and more informative, tidying up some other details while we're at it. We'll also see if we can compute a more meaningful miles-per-gallon average and look for other ways to have Basic store our data.

In the meantime, see if you can get this program to work for more than two fill-ups, and try to get it to work for an older car on which you have no previous gas usage and mileage data. If you haven't already done so, be sure to try the program out for your own car.

Don't forget to *save* your program; and make a backup copy before you start to change it. See you next time. ▲

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BY NELSON FORD

Although there are thousands of widely known programs in the public domain, these represent only the tip of an iceberg; there are many more potential PD gems that a lot of people don't know about—and may never know about. Before we get to the PD picks for this month, let's take a moment to talk about that unseen part of the iceberg.

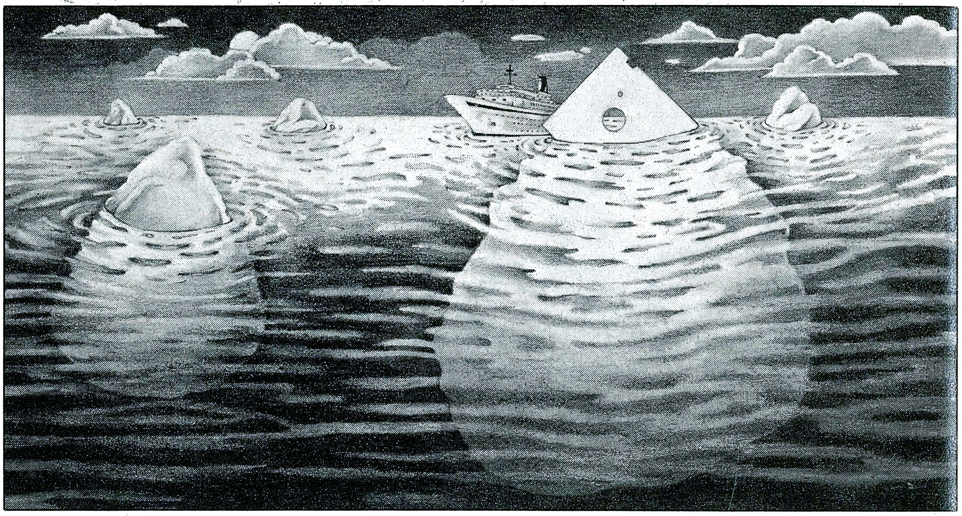
One reason some people don't contribute their programs to the public domain is that they don't know how to go about it; they don't know how to distribute their programs to others.

If you're looking for a way to make your PD program available to other PC users, consider contacting your local user group; they will more than likely be happy to swap their own PD software with you. Not only do you help out your fellow users by doing this, you also receive software in return.

If you're feeling really altruistic and you have a modem, you might upload your program to a bulletin board and let others download it. You won't get any software in return this way, but you may receive instant fame. Indirectly, you'll still get software in return, because your contribution will inspire others to share their programs.

If you think your program is too good to give away, but you don't have the time, money, or ability to put it on the market, you have a couple of options. One is to write an article about the program—or about some especially ingenious aspect of it. Many programmers have the notion that the people who write for computer publications dwell on some other plane of existence. In truth, anyone with a good idea and some ability to put words on paper can submit an article to a magazine. Send a letter to the editor describing what you have in mind and see what happens.

If you want to try for bigger bucks, consider the quasi-PD route: You allow users to copy and distribute your program but ask them to send you some specified amount of money if they do use it. If you decide on this approach, be prepared to put more effort into perfecting and documenting your software than you'd need to if you simply gave your program away. And although this approach may offset some of your investment in the program, don't expect to strike it rich.



Tim Egan

The original QPD program was Andrew Fluegelman's *PC-Talk*. For $25 (now $35), Fluegelman offered PC users a very good communications program, complete with source code and extensive documentation.

Unfortunately, the QPD approach is in danger. Some greedy souls spend a few days writing a trivial piece of code and then (figuring it never hurts to try) request payment from anyone who uses it. The problem is that as people catch on to this kind of ruse, they become less likely to compensate *anyone* who has written a QPD program. So if you're thinking of putting a program into the quasi-public domain, do yourself and your fellow programmers a favor and make sure your program is worth what you ask for it.

Let's move on now to the PD picks for June.

HC.com:

A hex-to-binary conversion program
by Marty Smith

Written in assembler, *HC* converts machine language programs from their normal binary-encoded format to hexadecimal. In hex format, the files can be transmitted easily over the phone by any communications program; the special protocols required for binary files are not necessary. *HC* also accomplishes the reconversion of the hex file to binary format for the benefit of the person on the receiving end of the transmission.

This isn't the first program written to convert files from binary to hex and back again. Several people have written Basic programs to accomplish this conversion. One popular early one was written by Jeff Garbers. Unfortunately, a conversion program written in Basic might take half an hour or more to convert a good-size file. Because *HC* is written in assembler, it can translate even large files in a few seconds.

The XModem communications protocol, which allows you to transmit com and exe files without converting them to and from hex, is beginning to gain wider acceptance. Many private bulletin boards already support XModem, and, by the time you read this, CompuServe should also have begun supporting it. When everybody is using XModem exclusively, we'll no longer need *HC*; until then, it's essential.

LoRes:

Aids for generating sixteen-color graphics
by Marty Smith

The technique for creating sixteen-color graphics with 160-by-100 resolution on the PC has been known since 1982, but *LoRes* is the first good implementation of the technique to become generally available. Smith provides a series of files containing technical information, machine code, guidelines, and samples for programming in lo-res sixteen-color graphics. Even if you do not program, the demo (written in assembler) is worth seeing.

Other PD Picks

Several programs to replace the DOS *type* command have appeared recently. The pri-

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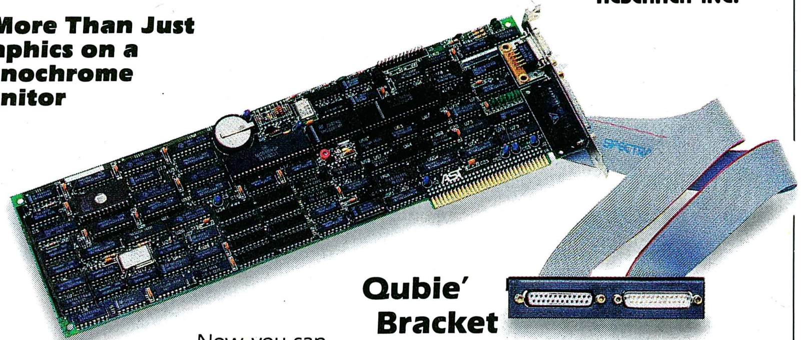

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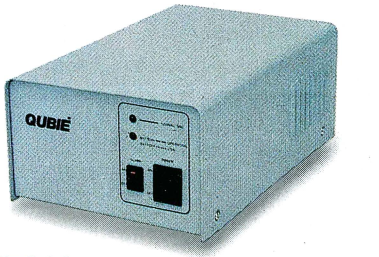

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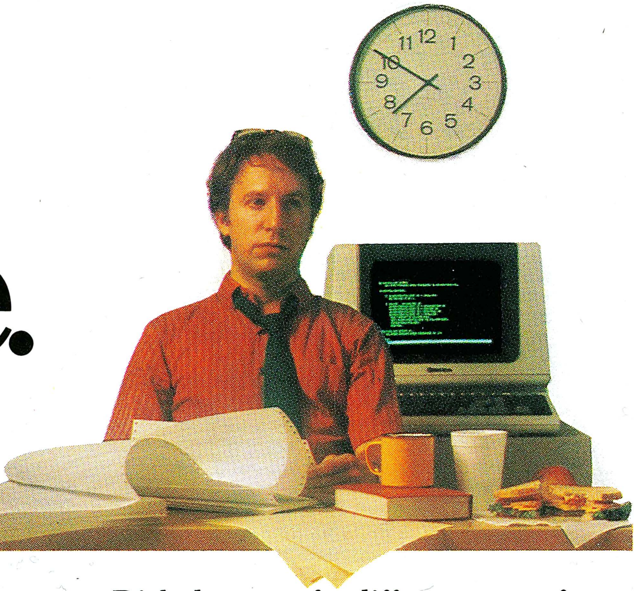

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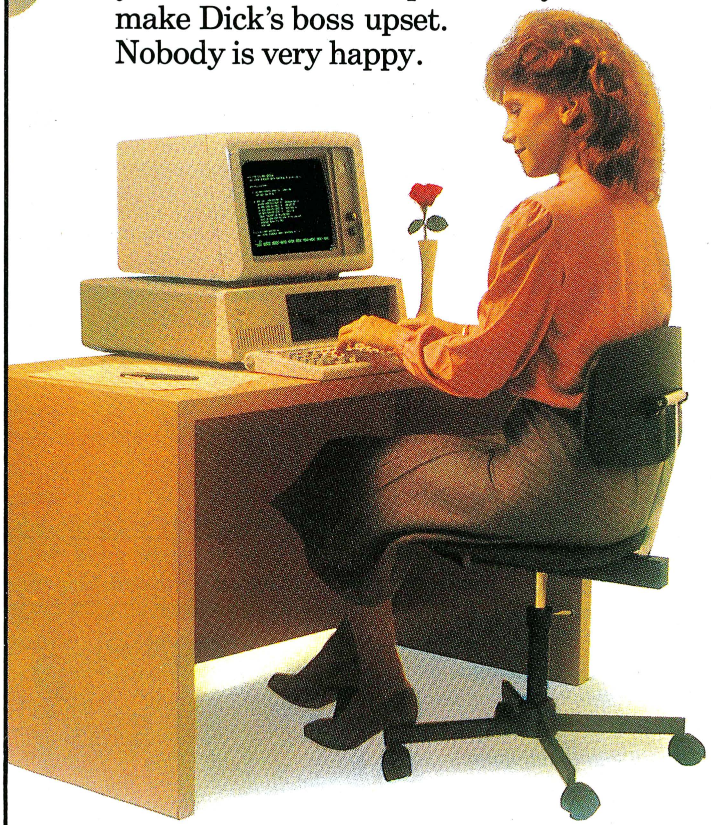

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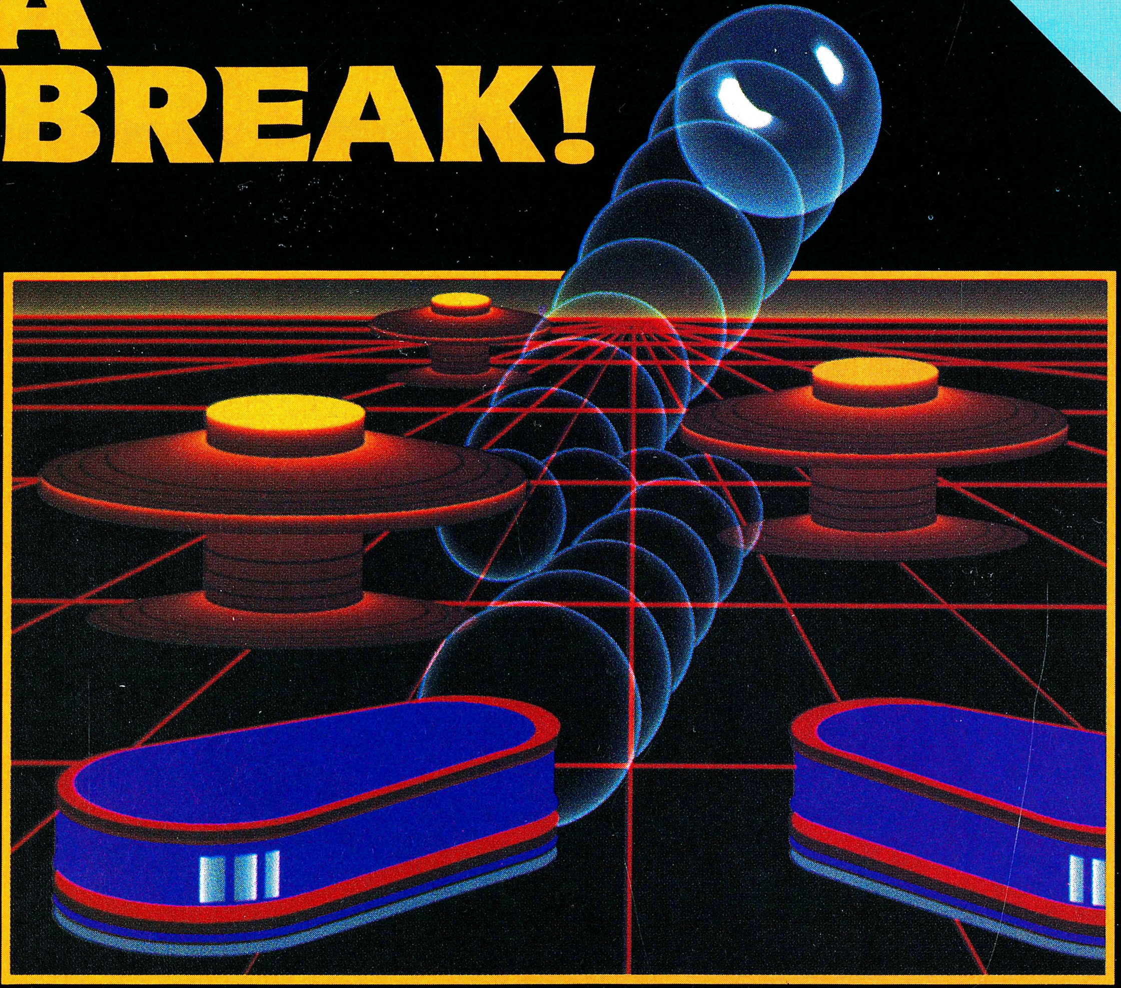

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mary feature of these programs is their ability to page backward and forward through a file a screen at a time. Using *type*, you can only read straight through a file.

List.com, by Vernon Buerg, allows you to page up or down a screen at a time or to page up half a screen at a time. With half-screen paging, it's easier to read a file, because you can still see what you were just reading before you went to the next page. However, the half-page scroll works only when you're paging up, so it's an advantage to those who like to start at the end and read toward the front. Maybe Buerg will give us another release with half-page scrolling in both directions. The assembler source code is not provided.

List also allows the printer to be toggled on and off. If you see part of a file that you want to print, toggle the printer on for that part; you don't have to print out the whole file. *List* will not start printing in the middle of a screen, and it won't let you scroll the screen a line at a time; so you can't print *exactly* what you want, but you're still better off than you'd be if you had to print an entire file to get just a couple of screens.

ST.com (Super Typer), by Charles Franklin, allows only full-screen paging; and Franklin requests $5 if you use his program. *Super Typer*'s star attraction is that it will translate a *WordStar* document file into straight text as it displays the file. It does not create a new, translated file, although with DOS 2's redirection feature, you might get it to do so. *ST* uses "sixty-four circular buffers" to store the file's screen pages. This means that with very large files you can't page from the end of the file all the way back to the beginning.

Re-View, by Vincent Bly, allows you to page back only three screens from the most current screen and doesn't work with the monochrome monitor. Bly requests $15 for his program.

Of the three, *List* has the most useful features and the lowest price (free). The odd thing about Bly's charging $15 for *Re-View* is that he includes with it several other programs for which he requests nothing. One of the programs included is *Bricks*, a nice implementation of the familiar "breakout" game.

DOS Shell Programs

DOS *shell* programs are designed to facilitate file-handling at the DOS command level. They allow you to do such things as page through a directory; sort the directory by filename, date, or size; and execute DOS commands or other programs, returning to the shell when done.

Cat.com is a quasi-PD program by Steve O'Kane and Ron Simmons. When invoked, it displays the default drive's directory and lets you scroll by line or screen. Following each filename is a twenty-five-character space where you can enter commands that will act upon the file in question.

The beauty of *Cat.com* is that it lets you enter commands for more than one file and executes them automatically one after the other. For example, you can enter *erase* for one file and *type* for another. Then you can press control-enter, and *Cat.com* will exit to DOS and carry out both the commands you just issued. When those commands have been executed, you'll see the DOS prompt with a large block cursor; at this point, you can press enter to return to *Cat.com*, remain in DOS, or run another program. *Cat.com* stays in memory, waiting for you to press enter at the DOS prompt.

Cat.com has some shortcuts built in. If you want to enter the same command on two successive directory lines, just enter the command on the first line and type an equal sign on the second; the equal sign copies the previous command directly into the current line. Entering /n for a file causes that file to be executed (that is, the program to be run). Entering a / in a command causes the current filename to be inserted into the command at the point of the slash. So, for example, *copy a:filename b:* can be abbreviated to *copy / b:*.

Cat.com allows you to toggle files between the hidden and visible modes and has several other features. It appears to work with most other software, including *ProKey, Scrollk, CgClock, WordStar,* and *1-2-3.* The program does have some bugs in it (calls to the authors have not been answered), but it's worth having anyway.

Util.com, from Mutant Software, is another shell program; Mutant asks $10 if you like it. *Util* has some of the same features as *Cat* (it lets you display a sorted directory, for example, and use the directory to specify a batch of DOS commands), but each program has some features that the other lacks, as you will see.

One advantage that *Util* offers is the ability to move easily through subdirectories. Unlike *Cat, Util* displays the names of subdirectories. To display the files in a subdirectory, you position the cursor on the subdirectory name and press enter. To go back to the root directory, press *L*.

Util also allows you to send the contents of one screen to a second monitor, if you have both a monochrome and graphics monitor, and to switch from one monitor to another. It allows you to send a file to the printer, or you can mark a file so that only specified lines are sent.

You can use *Util* to redefine keys using *device = ansi.sys* in a Config.sys file. *Util* also offers the ability to search for data in a text file; this feature can be nearly duplicated with DOS 2's *find* program, but *Util*'s search capability is more flexible.

Other Programs

Undo.bas, by Rich Schinnell, allows you to access files that you've saved via *Backup*.

Lu.com, by T. Jennings, chains several files into one and lets you separate them later. This is handy for archiving a set of files that you want to keep together. *Lu* does not compress the files.

DDate.com, by Hal Sampson, makes entering the date on bootup easier for the user who doesn't have a clock board.

GCopy & GDel, by Gordon Waite, allows batch copying and batch deletion of files.

123Prep.exe, by Jon Sims, converts a file with fixed-length records into the *1-2-3* prn file format. Great for files downloaded from a mainframe.

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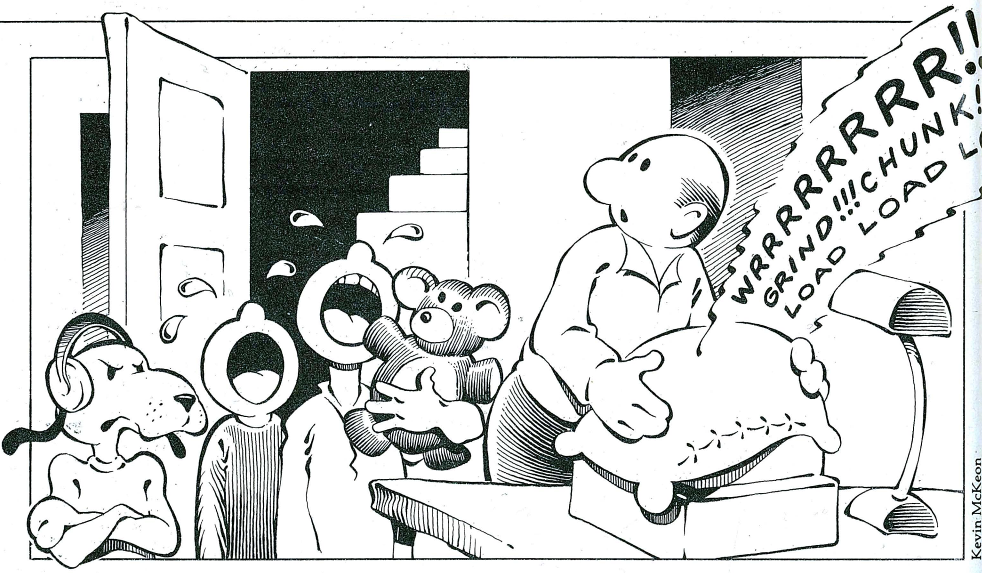
WRRRRRRRR!!
GRIND!!!CHUNK!
LOAD LOAD L

Kevin McKeon

Does this sound familiar? It's 3 a.m. and you have just completed the world's most comprehensive sock cataloguer (like everyone else you think small first and then work your way up). Of course this revolutionary piece of software is being developed on your 512K RAM drive (memory's cheap, right?). Time now to save this masterpiece on a mundane yet reliable floppy before the power company decides to send your program to that big bit bucket in the sky. Out comes the pillow, which snugly smothers the system unit's disk drives. You carefully tiptoe upstairs to make sure the bedroom doors are firmly shut. You close the basement door and stuff a towel in the crevice under the door. At last you're ready!

```
COPY*.* A:
```

As you press the enter key, you say a little prayer that this time you'll only wake up the kids—last time, the neighbor's doberman wanted a little piece of your throat.

Come on, you're probably saying, the Tandon drives on IBM PCs aren't *that* loud. Well, personally, I use them as an EOJ (End-of-Job) alarm. I fire up my super-duper general all-purpose batch file (in the RAM drive, of course) and go watch my favorite TV show (I have a slow compiler). The last statement in the batch file copies my source file to drive A. When the job is finished, no matter where I may be in the house. . . . Need I say more?

It seems that most of the bump and grind on these marvels of technology is caused by vibration that occurs when the arm steps to a new location. This stepping (or the rate thereof) is controlled by an entry in something called the Diskette Parameter Table. There's a pointer at 0000:0078 to 0000:007B that locates this table in memory. Thus, if you want to modify this table for whatever reason, you can construct your own table and change these pointer values. (In fact, every new release of DOS has done this.) Anyway, the first byte of this table contains what is known as a *step rate.* In DOS 1.1, this was set to eight microseconds; it was decreased to six microseconds in DOS 2.0. It turns out, however, that four microseconds gives the best result. I therefore submit the following patch, which describes how you go about modifying this parameter. Please pay careful attention.

Note: This patch is valid for DOS 2.0 and Tandon double-density drives *only!* I'm too lazy to figure it out for DOS 1.1.

In DOS 2.0, the parameter table is stored on the boot record of the system disk. The first patch modifies the appropriate byte in this boot record. For some reason, however, this table is only used by DOS on a warm boot. On a cold boot, Ibmbio.com constructs its own parameter table in memory. Thus the second patch modifies Ibmbio.com. To insert this patch, make a copy of your system disk and put it in drive A. From the DOS prompt enter:

```
A>DEBUG
```

to which Debug returns with its hyphen prompt. Then type:

```
L 0 0 0 10
```

and hit return. Type:

```
E 21
```

Debug responds:

```
xxxx:0021 DF.
```

Type *EF,* hit return, and then type:

```
E 1FC6
```

Debug replies:

```
xxxx:1FC6 DF.
```

Type *EF* again, hit return, then type:

```
W 0 0 0 10
```

Finally, type Q to quit Debug.

The only unfortunate thing about all this, of course, is that you can never again use your Tandon drives as an alarm.

Fulvio Castelli, Montreal, Canada

ProKey and Socha

I especially enjoy John Socha's toolbox articles; they're not only useful but instructive as well. The way the data statements are laid out is extremely convenient; the format Socha uses—with tabs between data items—makes the numbers easy to read and enter.

I have found, however, that an even easier way to enter these data statements is to let *ProKey* insert the commas and tabs. What follows is a *ProKey* routine I call *Socha.pro.* It works with *ProKey* version 3.0. Some slight alteration (changing ⟨begdef⟩ and ⟨enddef⟩ to ⟨Alt=⟩ and ⟨Alt-⟩ respectively) will allow it to work with previous versions of *ProKey.*

```
⟨begdef⟩⟨altz⟩data⟨tab⟩⟨vfld⟩ . . .
⟨vfld⟩,⟨tab⟩⟨vfld⟩. . .⟨vfld⟩,⟨tab⟩⟨vfld⟩ . . .
⟨vfld⟩,⟨tab⟩⟨vfld⟩. . .⟨vfld⟩,⟨tab⟩⟨vfld⟩⟨vfld⟩,⟨tab⟩⟨vfld⟩. . .
⟨vfld⟩,⟨tab⟩⟨vfld⟩. . .⟨vfld⟩,⟨tab⟩⟨vfld⟩
. . .⟨vfld⟩⟨ enter⟩⟨enddef⟩
```

With this routine, entering the data statements is simply a matter of

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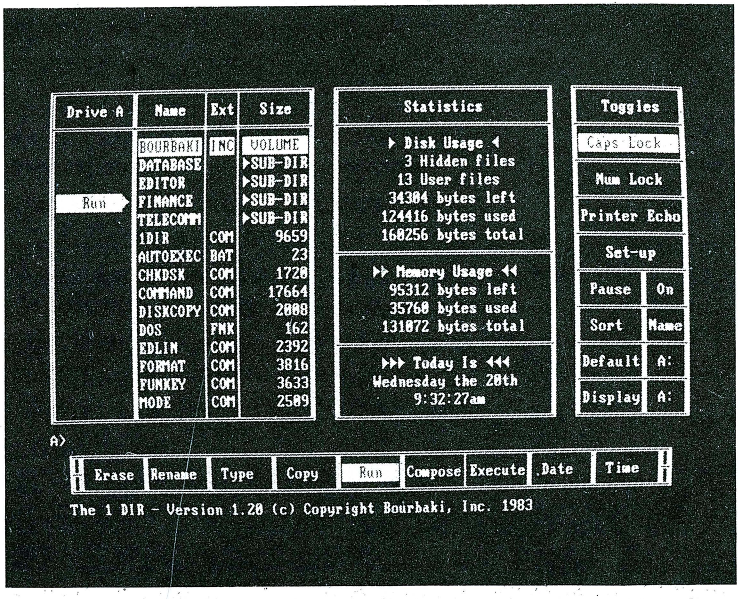
the 1 dir

"The Wonder"



```
Drive A    Name      Ext  Size        Statistics              Toggles

           BOURBAKI  INC  VOLUME      ▸ Disk Usage ◂          Caps Lock
           DATABASE       ▸SUB-DIR      3 Hidden files        Num Lock
           EDITOR         ▸SUB-DIR    13 User files           Printer Echo
  Run ▸    FINANCE        ▸SUB-DIR    34304 bytes left        Set-up
           TELECOMM       ▸SUB-DIR    124416 bytes used       Pause    On
           1DIR      COM     9659     160256 bytes total      Sort     Name
           AUTOEXEC  BAT       23                             Default  A:
           CHKDSK    COM     1720     ▸▸ Memory Usage ◂◂      Display  A:
           COMMAND   COM    17664      95312 bytes left
           DISKCOPY  COM     2008      35760 bytes used
           DOS       FNK      162     131072 bytes total
           EDLIN     COM     2392
           FORMAT    COM     3816     ▸▸▸ Today Is ◂◂◂
           FUNKEY    COM     3633     Wednesday the 20th
           MODE      COM     2509        9:32:27am
A>
  Erase  Rename  Type  Copy  Run  Compose  Execute  Date  Time
 The 1 DIR - Version 1.20 (c) Copyright Bourbaki, Inc. 1983
```

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William M. Mertens, State College, PA

On Whereis.com

When you use John Socha's program *Whereis.com* (*Softalk*, January 1984) on an XT or any other PC-compatible micro with a fixed disk, the screen scrolls too rapidly to let you read an extensive file listing. As an alternative to using control—num lock, I've written some lines of code that can be added to *Whereis.com*. This code stops the screen after twenty-three lines have printed; scrolling resumes when you press any key.

After the statement DATA_SEG SEGMENT PUBLIC add the following two lines:

```
LINE_CTR   DB   0
MESSAGE    DB   'PRESS ANY KEY WHEN READY'0AH,0DH,'$'
```

After the statement CALL SEND_CRLF in the procedure
WRITE_MATCHED_NAME, add:

```
      INC    LINE_CTR         ;INC LINE COUNTER
      MOV    AL,23            ;TEST FOR 23 LINES PRINTED
      CMP    AL,LINE_CTR
      JNE    WRITE_EXIT       ;NO—NORMAL EXIT
      MOV    AL,0             ;23 PRINTED, SO SEND
      MOV    LINE_CTR,AL      ;MESSAGE
      MOV    DX,OFFSET CGROUP:MESSAGE
      MOV    AH,9
      INT    21H
      MOV    AH,7             ;AND WAIT FOR ANY KEY
      INT    21H
WRITE_EXIT:
```

Then reassemble, link, and convert to a com file. This makes the screen easier to read when you list a large number of files.

John Tuccio, Westport, CT

Typefaces

I use my PC with *Typefaces* by Alpha Software to prepare my lecture notes. I recently purchased Microsoft's *Word* and found that default *Word* files don't run with *Typefaces*. After some experimentation I found that the following procedure will produce *Word* files that work with *Typefaces*, and I'm including it for anyone interested in using this combination of software tools.

Prepare the document with *Word* and use the *format division* command (or prepare an appropriate style sheet) to set the document's margins to top = 0, bottom = 0, left = 0, right = 3.

Use the *print file* command to create a disk file of the document with the margins specified in the *format division* command.

Use Edlin to get rid of any control characters that *Word* places in line 1 of the disk file. Be sure that dot commands intended for *Typefaces* are at the left margin in this file. Copy this modified disk file to a *Typefaces* data disk and run *Typefaces* in the usual manner.

I use an Epson MX-80 with Graftrax-Plus and print my file from *Word* to disk with the Epson MXG option in *Word*. Users with other printers may need to use an option appropriate for their particular printers. The important thing seems to be to keep the top, bottom, and left margins set to 0 and to eliminate the control characters (if any) in the first line.

Dr. Delo E. Mook, Hanover, NH

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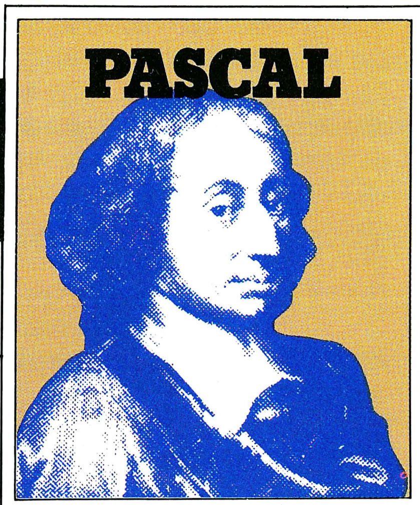

FROM BEGIN TO END

by Bruce Webster and Deirdre Wendt

Turbo Revisited

Our review of Turbo Pascal in the March installment of this column has generated more response than any other column to date (of course, that's not saying much, since most of you appear to prefer writing programs over writing letters). Therefore, a follow-up column seems in order, to correct some of the data in that column and to provide some additional information.

For starters, here's a letter we received from Harvey L. Lynch (Sunnyvale, CA)—and some comments on his remarks.

I recently acquired the Turbo Pascal compiler, and I like the product very much—especially the interactive user interface for debugging at both compile and execution stages. The compilation speed is indeed remarkable, on a par with a DEC VAX 11/780 and 10 percent of an IBM 3081-K in terms of CPU time per line of code.

I take issue, however, with the reviewers' opinion that Turbo is much faster in execution than IBM Pascal. It has been my experience using both the IBM and Turbo compilers that if both are asked to do comparable jobs, Turbo is almost invariably slower in execution speed than IBM. Notwithstanding the delicacy of benchmark tests (duly noted by the reviewers), one must at least make equivalent comparisons.

The prime sieve program, presumably the standard program published in many places, was listed as taking 15.6 seconds to execute under Turbo and 76 seconds with IBM Pascal. I agree with the 15.6-second figure for Turbo when none of the debugging options is enabled (the default state), but if the IBM compiler is used with debug options enabled so that it competes on equal footing (default for IBM is debug checking on), it runs in 12 seconds. A quirk in Turbo is that it normally does not allow a user to interrupt a running program except when I/O is being performed. Thus if the reviewers had tried to stop the prime sieve program in midcourse, they would only have been able to do so by rebooting. If the user interrupt is enabled, then Turbo slows down by a factor of 15! It is worth noting that this enormous factor-of-15 loss in speed is unusually severe for the prime sieve program; other programs I have tried indicate that the factor lies between 1.1 and 3. I have no explanation for the very large spread in degradation factors. The IBM compiler does not offer the option of ignoring user interrupts and does not share this malady.

It has been my experience that Turbo is slower than IBM Pascal by about a factor of five in doing pure floating-point operations (i.e., add, subtract, multiply, divide, and the standard functions sin, cos, atan, ln, exp, and sqrt). There is admittedly a problem in making a good comparison, since Turbo's real variables are six bytes long and IBM's are only four bytes, but it is still difficult to understand the factor of five. I do not understand the reviewers' result for floating-point operations, which indicated that Turbo-executable code is much faster than that of the IBM compiler. It may be that the difference between my experience and that of the reviewers is again the large overhead that accompanies the array checking, because the reviewers used a matrix multiply, presumably with all the IBM debug options enabled as with the prime sieve. What is clear is that both compilers could profit handsomely from using an 8087 coprocessor. There are several sources of 8087 support for the IBM compiler, but unfortunately none for Turbo (the new version of the Microsoft Pascal compiler apparently supports the 8087 as an option).

As Abigail might say, *mea culpa*. Yes, indeed, the $debug option makes a *big* difference in execution speeds. Let's talk for a minute about compiler options, and then we'll look at some revised benchmarks.

Most Pascal compilers allow you to specify how much runtime error-checking you want. The most common checks are for I/O and range errors; others include string parameter matching, divide-by-zero, and variable initialization. These options are turned off and on by special commands, such as *{$r+}*, *{$debug−}*, embedded in comment statements in the program. Usually, you turn options on during program development and then turn them off after the program is debugged to increase speed and decrease size.

Since they're embedded in the program, most options can be turned off or on for selected portions of code. For example, it's common practice to turn off I/O error-checking for routines doing interactive input of data. That way, for example, the user can't bomb the program by hitting a number instead of a letter. In such cases, the burden falls to the program (instead of the compiler) to handle any problems that might arise. In the case of I/O errors, you usually have some way of reading an error code and handling it appropriately (see the November 1983 through January 1984 columns for discussions on error handling in IBM Pascal, UCSD Pascal, and Pascal/MT+).

Turbo Pascal (in its IBM implementation) has eight compiler options (see pages 212 to 214 in the Turbo manual). Only two of these—array index checking and user interrupts (control-C abort)—are turned off by default. IBM Pascal has about thirty options, seven of which are turned on or off by the *$debug* option (see chapter 4 of the IBM Pascal manual). Of those seven, two are turned off by default: debugger entry point generation and integer initialization. Pascal/MT+ has about a dozen options; the three that generate error-checking code are turned off by default. UCSD Pascal (both implementations) also has about a dozen options, only two of which really affect execution speed. Of those two, one is turned off by default.

To make comparisons more fair, we reran all the benchmarks with the following options turned off:

Turbo	I−, R−, U−
IBM Pascal	DEBUG−
Pascal/MT+	R−, T−, X−

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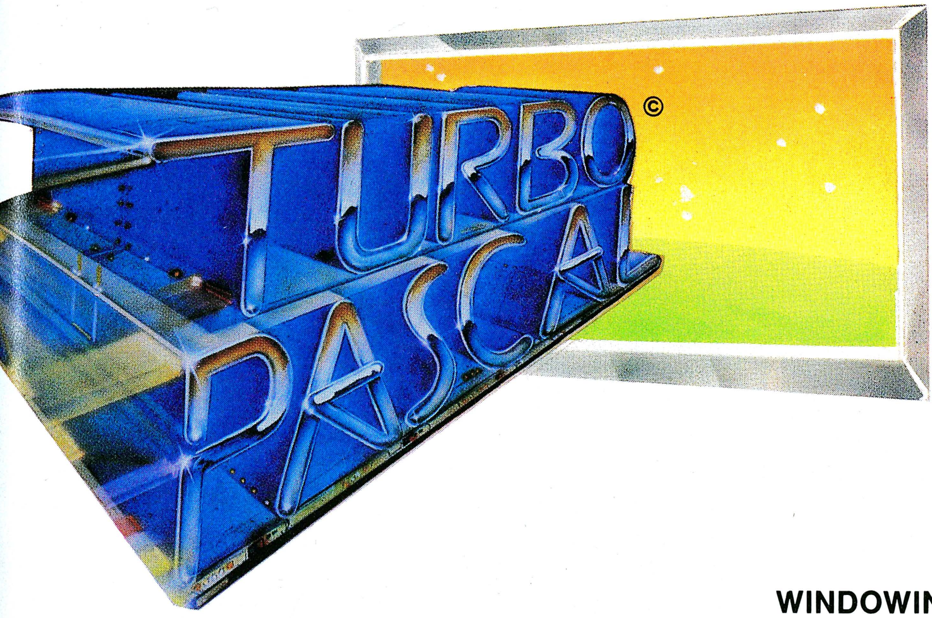

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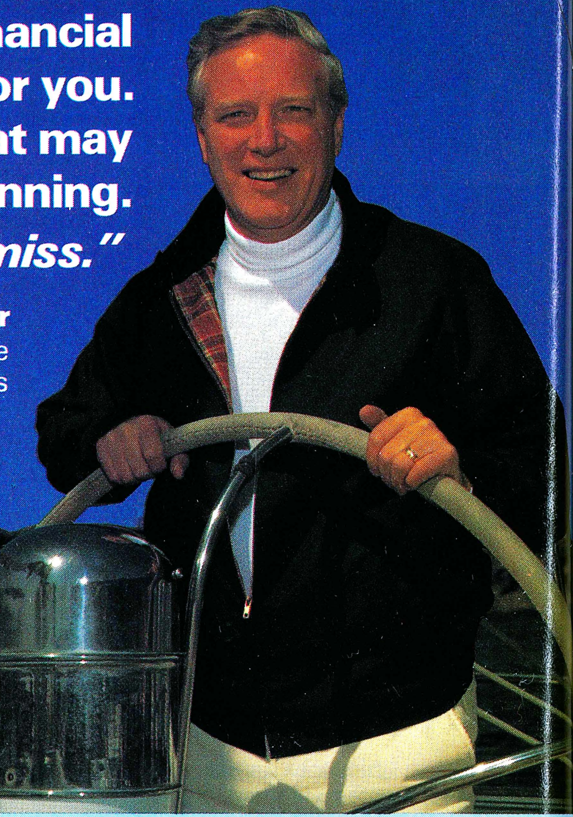

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UCSD/NCI R−, I−

The results are shown in figure 1. As Lynch said, IBM Pascal does much better and, in fact, beats Turbo Pascal in two of the four benchmarks. However, IBM Pascal is still slower (by almost a factor of two) than Turbo on the two versions of the matrix multiplication benchmark. Also of interest is the performance of the NCI/native code versions, coming in fourth, first, second, and second in the four benchmarks—not too shabby for "slow" p-code.

	Turbo	IBM	MT+	NCI	NCI/nat	UCSD	UCSD/nat
Compile time	4.9	61.8	62.1	25.8	24.8	29.9	29.0
Link time*	(1.0)	53.3	46.5	—	21.6	—	30.4
Exec code size	9086	32640	10752	—	—	—	—
Execution time	15.3	12.3	15.2	164.3	20.9	234.3	23.8

Integer Matrix

	Turbo	IBM	MT+	NCI	NCI/nat	UCSD	UCSD/nat
Compile time	6.8	80.5	68.9	31.9	33.1	38.0	38.1
Link time*	(1.5)	66.5	61.0	—	39.6	—	49.8
Exec code size	9622	32640	17408	—	—	—	—
Execution time	4.9	9.9	12.3	13.3	4.5	27.5	12.4

Real Matrix

	Turbo	IBM	MT+	NCI	NCI/nat	UCSD	UCSD/nat
Compile time	6.9	80.9	68.2	39.5	32.3	37.9	37.8
Link time*	(1.5)	66.1	61.3	—	40.8	—	51.1
Exec code size	9662	33536	17408	—	—	—	—
Execution time	10.5	18.9	40.0	20.8	13.9	51.5	39.4

String Sort

	Turbo	IBM	MT+	NCI	NCI/nat	UCSD	UCSD/nat
Compile time	8.8	79.3	68.7	23.9	24.0	37.9	36.3
Link time*	(1.4)	51.7	48.9	—	36.1	—	44.1
Exec code size	9667	24960	11264	—	—	—	—
Execution time	12.3	3.1	14.6	17.2	10.7	26.9	11.5

*Note: Turbo Pascal doesn't have to link. The value listed as "link time" is actually the RAM-to-RAM compile time. The link times for NCI/native code and UCSD/native code represent the time required for native-code generation.

Figure 1. Prime Number Generator.

So, apologies to all you IBM Pascal enthusiasts for the unjust benchmarks. Of course, this still doesn't change some of the other comparisons, such as disk space requirements (a factor of ten), executable code size (a factor of three), and compilation and linking time (factors of anywhere from fifteen to over a hundred, depending upon the comparisons you want to make). And, of course, there's the matter of cost ($50 versus $300).

Some of Lynch's other comments also deserve response. First, he's right about the slowdown if the user-interrupt option is turned on (*$u+*). The Turbo times change to 140.9, 6.7, 12.2, and 23.7 seconds respectively for each of the benchmarks, yielding slowdown factors of 9.2, 1.4, 1.2, and 1.9. However, we aren't bothered by the inability to abort out of a program at some point other than during I/O, since most of our programs tend to be I/O-heavy. Also, rebooting doesn't bother us much, either. All things considered, we'll keep the $U option turned off.

We take issue, however, with Lynch's observations about speed differences with floating-point operations. Figure 2 shows a benchmark program that uses the five most common real operands: +, −, *, /, and *sqrt*. The loop is executed 200 times, with the variable *a* going from 1.0 to 200.0. We ran this benchmark with the compiler option settings listed above. Figure 3 shows the results: IBM Pascal is faster, but by a factor of only 1.05, not 5. (We ran a similar benchmark using the functions *abs*, *arctan*, *exp*, *ln*, *sin*, and *cos*, just for Turbo and IBM Pascal. IBM was faster by a factor of 2.3, still a far cry from Lynch's claim.) What's amazing is that the NCI implementation of UCSD Pascal beat *everyone*. The people up at NCI must have done a lot of floating-point routine optimization. Pascal/MT+, on the other hand, is appallingly slow (and this is version 3.1, which, according to the release notes, had sped up the floating-point routines).

```
PROGRAM reals;
VAR
   a,b,c,d,e           : real;
   indx                : integer;
   ch                  : char;
BEGIN
   write('Hit any key to continue: ');readln(ch);
   a := 0.0;
   FOR indx := 1 TO 200 DO BEGIN
      a := a + 1.0;
      b := (a* a* a);
      c := b / a;
      d := sqrt(c);
      e := d - 1
   END;
   writeln(chr(7),'e = ',e:12:7)
END. { of PROGRAM reals }
```

Figure 2.

	Turbo	IBM	MT+	NCI	NCI/nat	UCSD	UCSD/nat
Compile time	7.6	61.6	61.4	23.1	23.7	28.2	28.4
Link time*	(0.8)	73.9	60.4	—	19.6	—	24.6
Exec code size	9043	32512	17408	—	—	—	—
Execution time	8.4	8.0	109.0	4.2	4.2	19.9	19.9
Significant digits	11	6.5	16	16	16	16	16
e = 0?	yes	no	yes	yes	yes	yes	yes

Figure 3. Real numbers test.

Another problem showed up with the real numbers benchmark: IBM Pascal printed out a nonzero value at the end, the only Pascal to do so. IBM Pascal uses only four bytes for its real numbers, which limits them to about 6.5 significant digits. Turbo Pascal uses six bytes (yielding eleven significant digits), while all the rest were set up for

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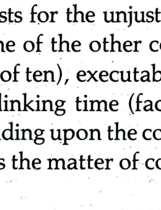

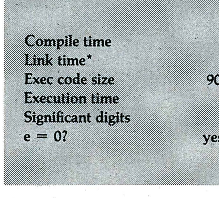

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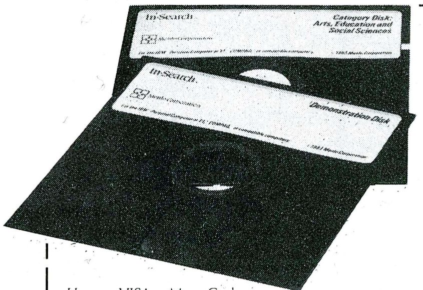

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As for 8087 support, Borland is releasing a version of Turbo that uses the 8087 chip (called Turbo87). The NCI p-System also supports the 8087 directly, as do Microsoft Pascal and Pascal/MT+. IBM Pascal (which is an early version of Microsoft Pascal) does *not* directly support the 8087; however, I assume from what Harvey says that libraries are available from third-party vendors that allow IBM Pascal programs to call the 8087 coprocessor. When I can get a system with an 8087 chip in it, I'll do some new benchmarks.

Turbo Bug Fixes. In earlier columns we've talked about the string-comparison bug in early versions of Turbo Pascal (which has since been fixed). As it turns out, there was an additional bug in the earliest copies that went out, a bug that sharply limited the precision of real numbers. If you run the program in figure 2 and get a nonzero result, then you've got the earliest version. Figure 4 shows the patch necessary to fix this bug for MS-DOS, IBM-PC versions. As for the string-comparison bug, figure 5 shows how to fix either MS-DOS version. If you have further questions, or if you have a version not covered here, contact Albert Holt, Technical Support Manager, Borland International, 4113 Scotts Valley Drive, Scotts Valley, CA 95066 (or call 408-438-8400).

Place your DOS disk (with Debug.com) in drive A and your Turbo Pascal in disk drive B. The boldfaced text shows what you should type:

```
A>DEBUG B:TURBO.COM
-E 0DBE
NNNN:0DBE 74.90[SPACE] 15.90
-W
WRITING NNNN BYTES
-Q
A>
```

Figure 4. Real number patch.

New Product Announcements. Borland International is releasing version 2.0 of Turbo Pascal. The two major implementation changes are the addition of true overlays and support of the standard procedure *dispose*. Overlays allow you to call in chunks of code as needed. This, combined with the chaining facility, should allow you to create large programs. *Dispose* provides an alternative to the *mark/release* approach to dynamic variable allocation that Turbo and other Pascals use. It gives you more flexibility in creating and (especially) disposing of dynamic variables, but it can cause problems with fragmentation of free memory (see the August '83 column for a discussion of dynamic variable allocation).

In addition to these changes, Turbo 2.0 offers several "goodies" (their word): expanded support of text mode as well as support of medium- and hi-res graphics. Besides allowing you to select between the different modes (with background and palette selection, where appropriate), Turbo also provides routines to plot points and draw lines. Also, you can define windows in both text and graphics modes. A sound routine is provided as well.

Follow the directions shown in Figure 4. Here is the patch for IBM-PC versions (MS-DOS):

```
A>DEBUG B:TURBO.COM
-E 08E5
NNNN:08E5 73.76
-W
WRITING NNNN BYTES
-Q
  A>
Here's the patch for all other MS-DOS versions:
A>DEBUG B:TURBO.COM-E 083D
NNNN:083D 73.76
-W
WRITING NNNN BYTES
-Q
  A>
```

Figure 5. String compare patch.

As mentioned earlier, a special version of 2.0, Turbo87, supports the 8087 math coprocessor. Turbo87 will not only make floating-point code run much quicker, but it will also support an eight-byte real number (instead of the usual six bytes), allowing you to have sixteen significant digits.

Digital Research has released version 3.2 of Pascal/MT+ for MS-DOS (which they call "PC DOS 86"). A slew of bugs have been fixed (the release notes list seventeen fixes to the compiler), and some new features have been added, including transcendental support of the 8087. The update costs $70 with documentation, $40 without. Distribution of the update is being handled by Alexander and Lord, 177 Webster Street, Suite A-3727, Monterey, CA 93940.

Network Consulting, Inc. (NCI) has released an introductory version of its p-System, called "Practical Pascal." It's geared toward students and novices and appears (from what's listed in the literature) to be fairly complete. The cost is $295, with educational discounts available. If we can get a copy (or, at least, more documentation), we'll let you know more about it. They're also offering three p-System support packages. PascalISAM is a B+Tree-based keyed ISAM file access package and is available for $645. *PascalForm* is a forms-generation package for designing screen and printer layouts. *p-Form* is a video forms package as well, selling for $215. NCI is at Discovery Park, Suite 110, 3700 Gilmore Way, Burnaby, B.C., Canada V5G 4M1; (604) 430-3466.

Slick Software has released the *Compiler Assist Program (CAP)*, a package designed to aid developers using IBM Pascal. We haven't tested it, but its function is automatically to go through the Pas1, Pas2, and Link stages, taking action should errors occur along the way. The cost appears to be $27.50 per copy. For more information, contact Craig J. Conrad, Slick Software, Box 641, Harrisburg, NC 28075, or call 704-455-5927.

Conclusions. Thanks for all your letters and comments—they let us know that people are really reading this column. Should you want to write directly, send your letters to Bruce Webster and Deirdre Wendt, 7907 Ostrow Street, Suite F, San Diego, CA 92111. We'll try to answer you directly or through this column. ▲

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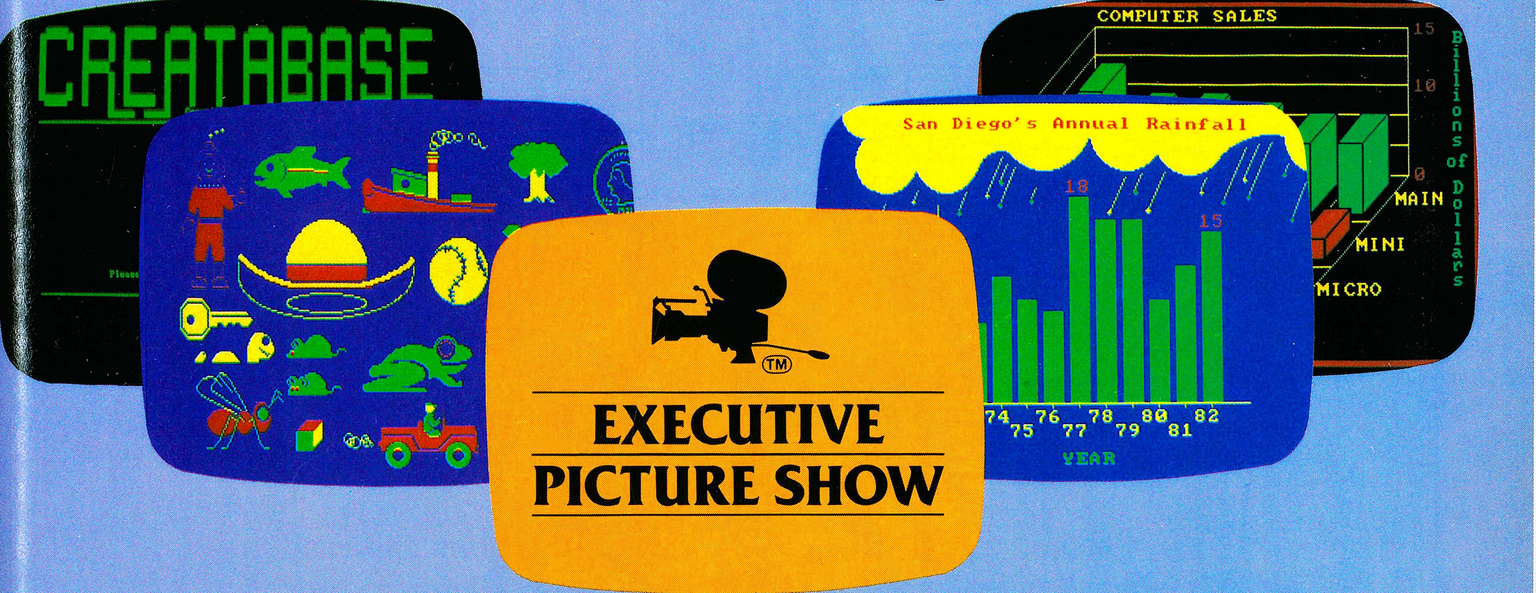

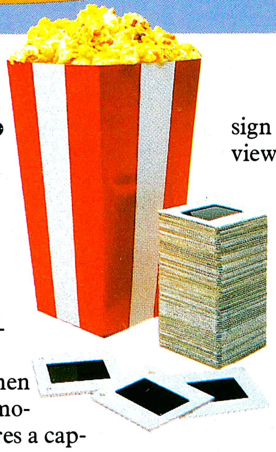

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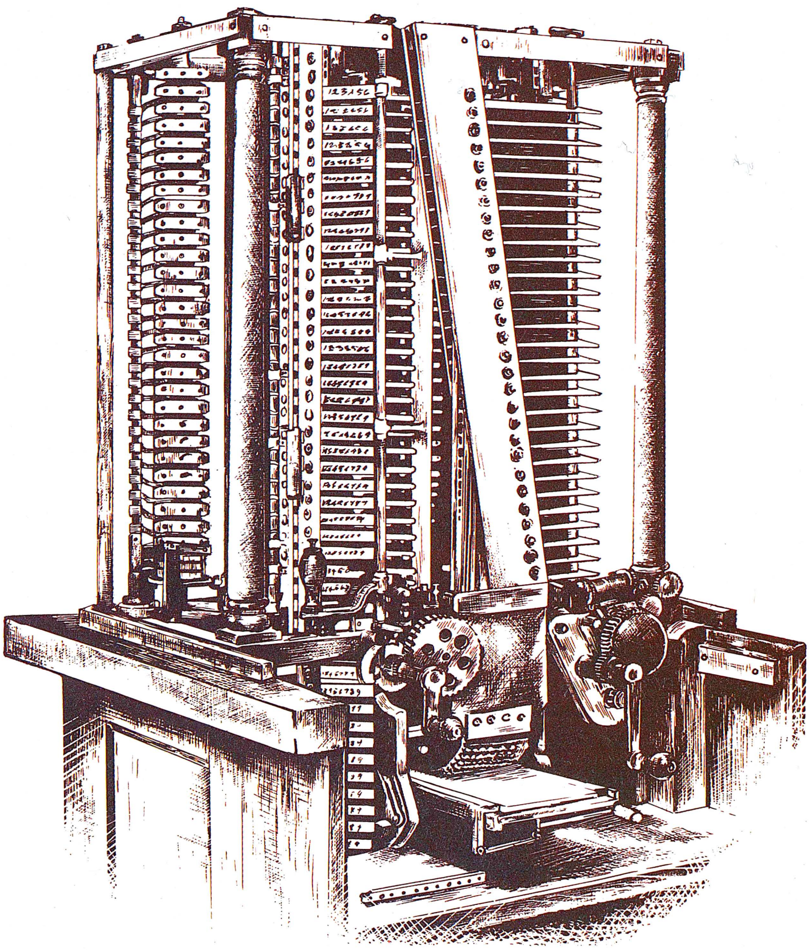

8087 SUPPORT FOR THE BASIC COMPILER

BY ED BOGUCZ

Scientific and engineering computing on a PC is a challenge for programmers working with IBM's current Basic language products. IBM's Basic interpreters and compiler are constrained to a 64K workspace, which limits the size of a program and its data. In addition, the current Basic products can't drive Intel's 8087—the math coprocessor chip that gives the PC impressive number-crunching capabilities.

Several independent firms have introduced products to make IBM's Basic better suited to scientific and engineering computing. These products, which enable the Basic compiler to produce much faster code for large applications, include compiler libraries that support the 8087 and routines that extend the available data space to the machine's limits (640K). This month we'll look at several of these enhancements.

Four firms offer products that give 8087 capability to the Basic compiler: Field Computer Products, Hauppauge Computer Works, MicroWare, and Seattle Computer. Their products differ in intent, implementation, computational effect, and cost. You should evaluate your needs carefully when choosing 8087 support for Basic programming.

The Basic compiler can drive the 8087 in two ways. The libraries distributed with the compiler can be replaced with libraries that use the 8087 for numeric operations; or a set of primitive functions can be defined to let the programmer oper-

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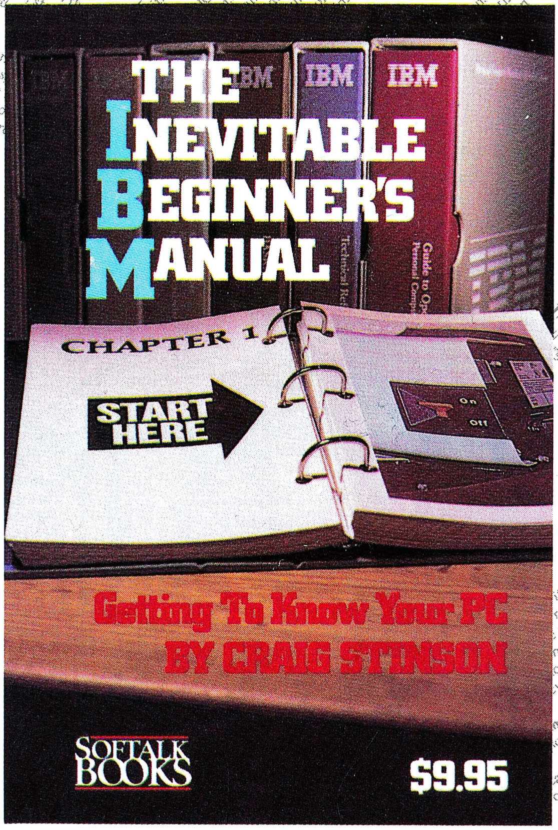
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ate the 8087 directly from Basic. Each alternative is implemented in products available from several firms. We'll discuss the replacement libraries first and then contrast that approach with the primitive-function alternative.

8087 BASIC LIBRARIES

Let's start by reviewing the role of libraries in compiler operation. A compiler library is essentially a storehouse of machine instructions for fundamental operations, such as multiplication or exponentiation. When processing a user's program, the compiler notes which library routines are required to produce the desired results for each statement. After the program compiles, a user links the program object file with the compiler libraries. The linker retrieves machine instructions from the libraries for each routine cited by the compiler and inserts them in the appropriate places in the user's code.

With the IBM Basic compiler, the user, at compilation time, makes an important choice between two linking alternatives. The standard (default) choice is to link with the runtime library Basrun.lib. If this path is selected, the runtime module Basrun.exe is loaded with the user's code at execution time. The other alternative (the /O compiler option) is to force the linker to produce a self-contained run file. This method produces code that runs faster, at a cost in flexibility; you can't chain programs that have been compiled with the /O option.

The libraries distributed with the IBM Basic compiler contain instructions only for the PC's microprocessor, the Intel 8088. Thus a straightforward way of using the 8087 with the IBM compiler is to replace the standard libraries with new versions that incorporate instructions for the NDP in numeric calculations. This approach is taken by Hauppauge Computer Works, MicroWare, and Seattle Computer.

The three companies' products differ in two fundamental areas: the handling of the mismatch between the IBM and 8087 real-number formats (see last month's article for more about this mismatch), and the flexibility available to the user during program linking. The vendor's approach in each area can affect the performance and utility of the product. We'll discuss the approaches used in each vendor's product and then present some benchmark times for two simple example programs.

The products from Hauppauge Computer Works and Seattle Computer handle the real-number format mismatch similarly: They convert from IBM/Microsoft format to Intel/IEEE and then back again in every numeric operation. For example, the instructions for multiplication would require converting both multiplicands from IBM/Microsoft to Intel/IEEE format, loading the numbers into the 8087, executing an NDP multiplication instruction, storing the product in Intel/IEEE format, and, finally, reconverting the product to IBM/Microsoft format.

The constant conversion of numbers between formats obviously takes time and therefore degrades the apparent performance of the 8087. For fast-running calculations, such as addition and subtraction, the conversions take as much time as the operations themselves. Even so, the speed of the NDP means that numeric operations still take place faster with this method than with the 8088 instructions in the original compiler libraries.

MicroWare takes a more fundamental approach to the real-number format mismatch problem. They eliminate the problem at its source by supplying a modified version of the IBM compiler that produces only IEEE constants. Since this modified compiler doesn't require conversions between formats, it can produce faster-running code. The possible difficulty with this approach is that numbers stored in random-access files generated with the Basic interpreter (or the original IBM compiler) will be incompatible with the modified compiler. MicroWare provides simple routines that allow users to do the required conversions.

In addition to increased speed, MicroWare's products give the user more flexibility during program linking. MicroWare provides both a modified runtime module (Basrun.exe) and a complete compiler library (which replaces Bascom.lib), so users have a choice about the execution of their programs.

Hauppauge Computer Works and Seattle Computer don't supply runtime modules. As a result, their libraries require the use of the compiler /O option. As noted previously, the /O option prohibits program chaining, which may be an undesirable constraint in applications requiring long programs.

To get a feeling for the effects of the different 8087 libraries, we applied the products from Hauppauge Computer Works and MicroWare to the two example problems presented earlier in this series (April 1984). (Seattle Computer's library wasn't available for this review. Because of the similarity of their format-conversion techniques, you can expect the performance of Seattle's package to be similar to that of Hauppauge Computer's.) Recall that one example problem is the calculation of 2,100 logarithms for the Babbage Log Table. The other test case is the multiplication of two twenty-by-twenty matrixes, a problem that requires eight thousand multiplications and eight thousand additions.

Table 1 shows execution times for various solutions of each problem in single and double precision. Included are times for the IBM Basic interpreter, the original IBM Basic compiler (both with and without the /O option), the compiler library from Hauppauge Computer Works, and the modified compiler and libraries from MicroWare (with and without /O). Also listed are times for the 8087 assembly language programs discussed in April.

The results listed in table 1 confirm our expectations about the per-

	BABBAGE LOG TABLE (2100 logs)		20x20 MATRIX MULTIPLICATION	
	Single Precision	Double Precision	Single Precision	Double Precision
IBM Basic interpreter	35.6	155.9	83.6	96.3
EXECUTION WITH RUNTIME MODULE:				
IBM Basic compiler	11.0	28.6	7.6	11.7
MicroWare modified compiler	2.34	2.50	4.45	4.80
STANDALONE RUN FILE: (produced with compiler /O option)				
IBM Basic compiler	10.3	27.8	6.12	10.2
Hauppauge compiler library	2.56	3.76	5.28	8.80
MicroWare modified compiler and library	1.57	1.72	2.94	3.29
8087 PRIMITIVE FUNCTION CODE:				
MicroWare primitive function library with modified compiler	1.35	1.37	2.14	2.21
MicroWare *MatrixPak*	—	—	0.962	1.064
8087 ASSEMBLY LANGUAGE CODES	0.681	0.695	0.497	0.598

Table 1. Sample problem execution times (all figures in seconds).

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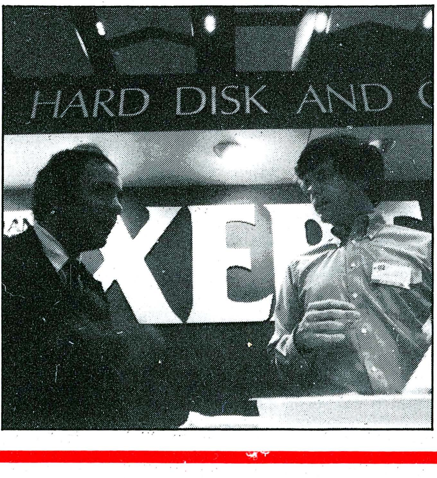

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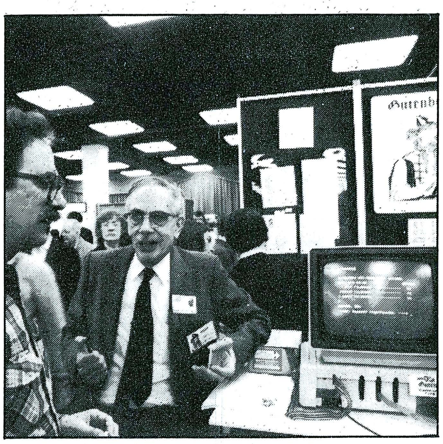

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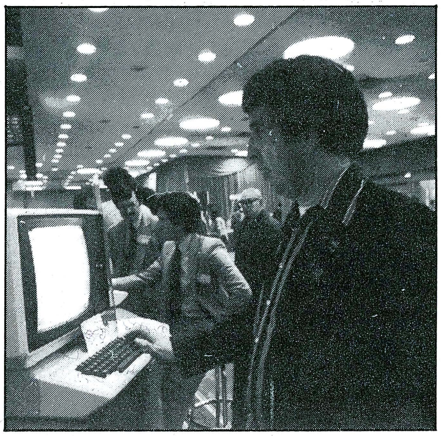

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ONE FRUSTRATING LIMITATION OF THE CURRENT IBM BASIC PRODUCTS IS THE 64K MAXIMUM WORKSPACE AVAILABLE FOR PROGRAM AND DATA.

formance of the different products: Eliminating required conversions improves execution speed. MicroWare's libraries and modified compiler produce faster code than Hauppauge's libraries and the original compiler. The difference between the approaches is especially apparent in code that contains mostly simple operations like addition and multiplication. For example, the overhead from conversions limits the benefit of Hauppauge's library to a 14 percent reduction in execution time for the matrix multiplication problem; MicroWare's reduction is more than 50 percent for a similarly linked code. The penalty paid for conversions is less apparent in problems that involve many transcendental function evaluations, such as the log table.

8087 PRIMITIVE FUNCTIONS

The second alternative for driving the 8087 with the Basic compiler is to create a set of primitive functions that allow the user to operate the NDP directly. Using this approach, programmers can write 8087 assembly language routines from within Basic. Generally, such programs are faster than those that use the compiler libraries. In addition, programmers can take advantage of some complex 8087 functions that have no counterparts in Basic.

Two vendors offer libraries of primitive functions: Field Computer Products and MicroWare.

The use of primitive functions is best described by an example. Figure 1 shows a standard matrix multiplication routine in Basic. The code performs the multiplication C = A * B, where A is an L x M matrix and B is M x N. An equivalent code using MicroWare's primitive functions is shown in figure 2 (both listings are in single precision).

```
800 'MATRIX MULTIPLICATION ROUTINE:
810 'Compute C = A * B when A is LxM and B is MxN.
820 '
830 FOR I = 1 TO L
840   FOR J = 1 TO N
850     SUM = 0!
860     FOR K = 1 TO M
870       SUM = SUM + A(I,K) * B(K,J)
880     NEXT K
890     C(I,J) = SUM
900   NEXT J
910 NEXT I
920 RETURN
```

Figure 1. Standard Basic matrix multiplication routine.

```
800 '8087 PRIMITIVE FUNCTION MATRIX MULTIPLICATION:
810 'Compute C = A * B when A is LxM and B is MxN.
820 '
825 CALL FINIT 'Initialize 8087
830 FOR I = 1 TO L
840   FOR J = 1 TO N
850     CALL FLDZ 'Load 0 onto top of stack
860     FOR K = 1 TO M
865       CALL FSRLD(A(I,K)) 'Push A(I,K) onto stack
870       CALL FSRMUL(B(K,J)) 'Multiply stack top by B(K,J)
875       CALL FADDCS 'Add product to accumulating sum
880     NEXT K
890     CALL FSRSTP(C(I,J)) 'Store C(I,J) and pop stack
900   NEXT J
910 NEXT I
920 RETURN
```

Figure 2. Matrix multiplication using MicroWare's library of 8087 primitive functions.

As you can see by looking at figure 2, a programmer using primitive functions essentially writes an 8087 assembly language routine from within Basic. The calculations for each element C(I,J) begin by loading a 0 onto the 8087 stack. The usual inner product calculation proceeds by pushing element A(I,K) onto the stack and then multiplying it by element B(K,J). The classic stack add operation (MicroWare's FADDCS) adds the top two stack elements and pops the stack, leaving the result on the top of the stack ready for the next pass through the loop. When the inner product loop has been completed, the top of the stack is stored in C(I,J) and the stack is popped.

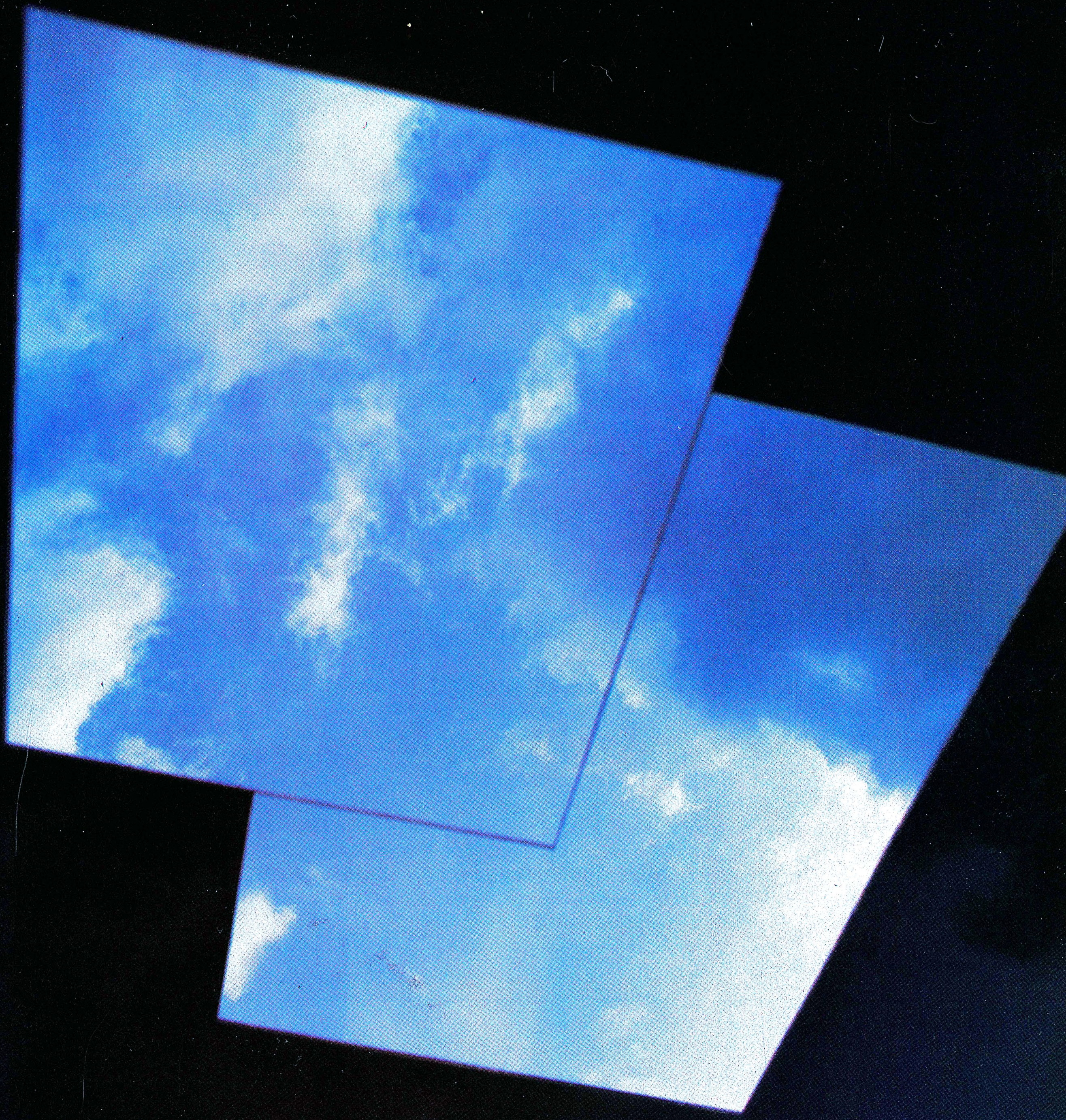
Table 1 includes execution times for programs written with MicroWare's primitive functions and compiled with their modified compiler (using /O). Note that the primitive-function method produces faster programs than the 8087 Basic libraries alone. In particular, the execution times for the matrix-multiplication test are reduced by about 30 percent. Primitive functions seem especially well suited for applications, such as matrix multiplication, where intermediate results can be kept in the 8087 registers instead of being swapped in and out of memory. In practice, programmers can use primitive functions to optimize processing of computation-intensive routines. They are a powerful complement to general-purpose 8087 Basic libraries.

The most significant difference between the primitive function library of MicroWare and that of Field Computer Products has to do with the handling of the IBM—Intel real-number format mismatch. MicroWare's primitive function library is designed to be used with their own modified IBM compiler, so they have no format mismatch. Field's primitive functions are intended to be used with the original IBM compiler, and the user is responsible for converting between the IBM and Intel formats. Field provides conversion routines for single-precision reals but not for double precision. The lack of double-precision conversion routines significantly limits the utility of Field's package for scientific and engineering programming applications.

EXTENDED DATA SPACE

One frustrating limitation of the current IBM Basic products is the 64K maximum workspace available for program and data. The workspace limit means that scientific and engineering programs requiring large arrays must be compromised in order to be handled by IBM Basic. As part of its 8087 support, MicroWare offers two products that effectively eliminate restrictions on memory devoted to data storage. One product is the previously described library of primitive functions. Included in this library are functions that load, store, and manipulate variables located anywhere in the PC's memory. The only hitch is that you have to tell the routines the exact location (segment and offset) of any referenced variable. But if you can do your own memory management, you can have access to all your installed memory from within MicroWare's modified Basic compiler.

MicroWare relieves the user of the details of memory management with a package devoted to matrix operations. Using *Matrixpak*, the



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programmer only has to specify the location and size of the area in memory to be devoted to the storage of matrixes. Next, the programmer defines the size and type of the matrixes to be used through a routine analogous to a Basic *dim* statement. *Matrixpak* takes care of the details of where elements are located in the matrix storage area. The memory management technique used in the package limits matrix size to 64K per row. In practice, this means that matrix size is limited only by the amount of contiguous RAM in your machine—up to the PC's 640K limit.

In operation, the matrix storage area is external to Basic's data space, so matrix elements are stored and retrieved through *Matrixpak* subroutine calls. For example, the storage of variable Const in matrix element C(I,J) requires the statement

```
CALL PUTM(IC,CONST,I,J,IER).
```

Here, IC is an index that identifies the number of the matrix in the *Matrixpak* storage area; if matrix C was the third matrix defined, IC would be equal to 3. IER is an error flag tripped if I or J is outside the defined matrix bounds. This method of accessing matrix elements is sometimes inconvenient, but it's the only choice for increasing the data space size, given the current IBM Basic compiler.

MicroWare mitigates the inconveniences of accessing matrix elements by also providing routines for several standard matrix operations. Included are subroutines for equating matrixes, swapping rows, and dividing elements on a row by a constant. Also included are routines for matrix multiplication and Gauss-Jordan elimination. The Gauss-Jordan routine can directly produce either a matrix inverse or the solution of a system of linear equations.

As an added attraction, MicroWare says that the routines are written with speed in mind. They say all their routines "exhibit throughputs approaching the theoretical limit of the 8087." Indeed, a test of the general-purpose matrix multiplication routine showed that its speed compares favorably with the special-purpose assembly language codes developed for this series (see table 1). *Matrixpak* would seem to be a valuable and powerful tool for anyone working with large arrays and the IBM Basic compiler. It also can be used with the Microsoft Fortran and Pascal compilers.

CONCLUSIONS

On the whole, the most complete family of 8087 programming aids for the IBM Basic compiler is provided by MicroWare. MicroWare's modified compiler is the most logical and efficient way of handling the mismatch between the original IBM real-number formats and those used by Intel. MicroWare's libraries offer the greatest flexibility for program execution. In addition, MicroWare offers a powerful set of NDP primitive function routines that allow the user to control the 8087 directly from within a Basic program. A matrix-calculation package that removes all constraints on the amount of memory committed to data storage completes MicroWare's family of 8087/Basic support products. Taken together, MicroWare's package makes the IBM Basic compiler a fairly powerful tool for scientific and engineering programming.

Field Computer Products (909 North San Antonio Road, Los Altos, CA 94022; 415-949-3457).

Basic87. 8087 primitive function set. $50.

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87 Software Pak. Macro library for *Masm* and compiler libraries for Basic, Pascal, and Fortran. $180.

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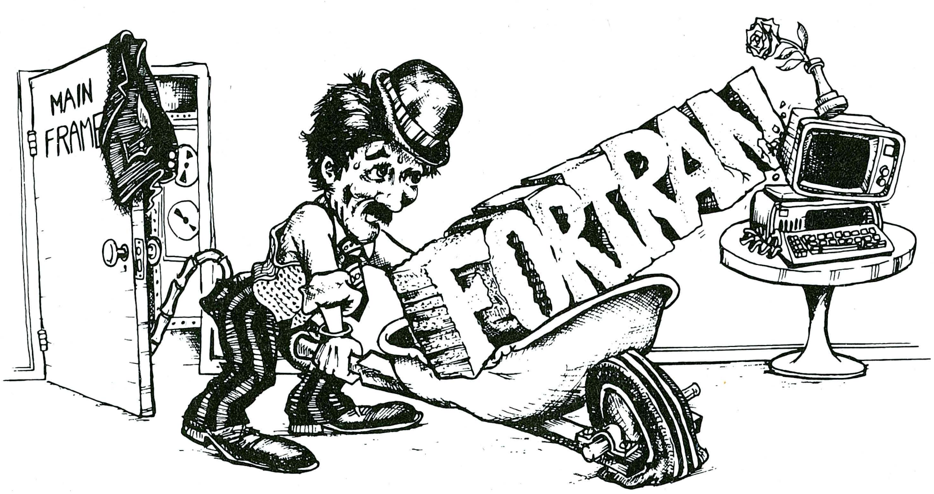

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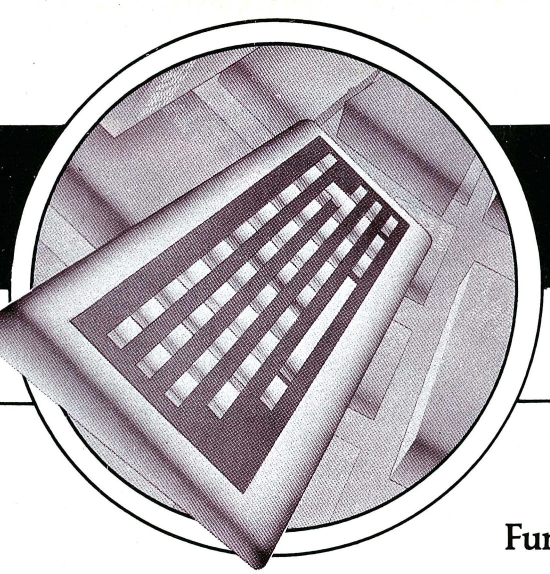

BEGINNERS' CORNER

by Kathy Talley-Jones

Fun and Useful DOS Commands

For the past few months we've been looking at a number of DOS commands that help us in our everyday work with application programs. DOS, as you remember, provides the working environment for the software most commonly used by PC and PC*jr* owners. The commands we've examined so far are *format*, which prepares a disk so that files can be stored on it; *diskcopy*, which makes an exact copy of one disk onto another; *copy*, which copies individual files (or entire disks, file by file); *rename*, which renames files; *erase*, which erases individual files (and can be used to erase an entire disk); and *dir*, which displays the directory—a listing of a disk's contents.

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Now we'll take the opportunity to look at an assortment of other useful DOS commands. These commands—*ver, vol, date, time, cls,* and *type*—may not be commands you'll use every day, but you're sure to find them handy nonetheless.

Ver. DOS has been in use on IBM microcomputers for two years now and has undergone some evolution during that time. When the PC was introduced in 1982, the operating system that IBM first made available for it was DOS version 1.0. DOS 1.1 quickly followed, and in March 1983, DOS 2.0 was introduced. DOS 2.1 became available at the time PC*jr* was announced.

Just because DOS 2.1 is the most recent version available doesn't mean that everyone uses it. Many people still use 1.1, and *most* people using PC-XTs use DOS 2.0, not 2.1.

You'd think the variety of DOSes in use would cause a certain amount of confusion. You're right, it does. There are in fact business organizations in which some people use DOS 1.1 while others have moved on to one of the later versions. This situation is likely to cause more trouble for the group using 1.1 than for those using DOS 2 or 2.1. That's because DOS 2 is able to read files on disks formatted under DOS 1, but DOS 1 may or may not be able to read a disk formatted under DOS 2.

A DOS 2 disk formatted with the */8* option, as:

FORMAT B:/8

can be read under DOS 1; such a disk will be organized into eight-sector tracks instead of DOS 2's normal nine sectors. "Normal" DOS 2 disks (those formatted without the */8* option) cannot be read in the DOS 1.1 environment. If you've ever been working in DOS 1.1, asked for a directory of a disk, and had it come up all hearts and faces and act all balky, then you've seen for yourself what DOS 1 does when it tries to read a disk formatted under DOS 2.

That's one way to find out you're in the wrong environment. Fortunately (for DOS 2 users, at any rate), there's an easier way. Just type

VER

If you are working in DOS 2 or 2.1, you'll see something like:

IBM Personal Computer DOS Version 2.10

If you're not. . .if you're working in DOS 1.1, CP/M-86, the UCSD p-System, Unix, or some other operating system, you will not see this message or anything like it. You'll get an error message:

Bad command or file name

and you'll know that the operating system loaded into your machine's memory isn't DOS 2 or 2.1. Mind, we're talking here about the system present in your computer's internal memory, not the system under which the disk in your disk drive was formatted. These will not necessarily be the same; you can, for example, boot your system with a DOS 2.1 system disk in the drive, then swap that disk for a disk formatted under DOS 1.1. There's no problem in doing that. The point here is merely that the *ver* command indicates the version of DOS under which you booted your machine; it says nothing about the format of the disk in your drive.

The reason, incidentally, that you get an error message (instead of some more direct information) if you use the *ver* command in DOS 1.1 is that DOS 1.1 doesn't understand *ver*; that command was introduced with the 2.0 revision of DOS. (It's worth noticing that error messages are often useful and informative, even if unpleasant to receive.)

Vol. Some people are so organized they remember to include the volume parameter (*/V*) whenever they format disks, thus cataloguing their files in a tidy manner that is the envy of their comrades. These people can use the *vol* command to see what the volume labels on their disks are. The rest of us have to scrabble

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Missing an installment of "Beginners' Corner"? The current column began in February 1984, but all back issues are still available; for further information, see page 4. The first "Beginners' Corner" columns (June 1982—September 1983) are now available as a single volume from Softalk Books.

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Such is the price of spontaneity.

Date* and *Time. If you're one who tends to sail through DOS's *date* and *time* prompts by giving the return key two sharp raps at bootup time, and who is later struck with remorse on that account, you can redress your negligence after booting by typing *date* and/or *time* and giving the proper responses. Your computer will take to heart the new information you give it. If you want confirmation that your machine does indeed know the time and date, all you have to do is retype either command; it'll parrot back what you told it, figuring in the odd nanosecond or two that may have elapsed since you issued the commands in the first place.

Cls. Have you ever finished using a program and found the DOS prompt *A>* shining from the middle of a jumbled garden of words left on the screen by the recently departed application? If this happens and you have a little DOS business to conduct, you can issue the *cls* command, thereby wiping all that jumble away. This command, not included in DOS version 1, is a good idea borrowed from Basic (Basic has a similar command to clear the screen). When you issue the DOS *cls* command, your cursor will return to the "home" position on the screen (the upper left-hand corner). Any foreground and background color selections you may have made will remain in effect.

Type. Because DOS files must be given such short names (that eight-letter limit can try even the most inventive mind) we sometimes find ourselves at a loss to remember what a file contains. If you have one of these mystery files lying around and you don't feel up to reexamining it by getting back into the application in which you created it, you can let DOS do the work. Issue the *type* command:

```
TYPE MYSTERY.DOC
```

(or whatever your file's moniker may be) and DOS will throw the contents of your file onto the screen.

But what's that, you say? Along with a few intelligible phrases you're getting hearts and faces? Why doesn't this file look just the way it did in the application program you used to create it?

Not all files produce intelligible output in response to the *type* command. Let's explore this matter a bit further and start by using the *type* command to scrutinize some of the files on the DOS disk, starting with the file Find.exe.

Tell DOS to

```
TYPE FIND.EXE
```

DOS will print a line on your screen, the cursor will race through a few blank lines, and then a few more lines—containing some letters, card suits, and punctuation marks—will appear. Finally, you'll get a beep for your troubles. That's that; doesn't look like much, does it? Now let's look at a Basic file.

Colorbar.bas is one of the smaller files you'll find on the supplemental DOS 2.1 disk. This file contains a Basic program whose function is to display the sixteen colors available on the PC*jr*. Pretty much the same thing happens when you type this file as when you type Find.exe, except the cursor doesn't spend any time running through blank space. This time, however, you can read the words, "The IBM Personal Computer Colorbar," and you can see a few phrases in quotes, such as "Personal Computer", mixed in with the sunbursts and nautical flags. From this you can formulate a vague idea of what the file contains.

Why do these files look like this when you type them?

The answer has to do with the form in which the computer stores information in files. We'll take up this topic—and explore further the ins and outs of the *type* command—when we meet next month. ▲

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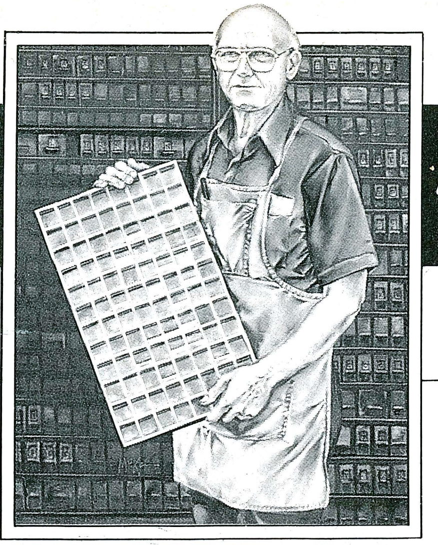

The Printed Word

by John Dickinson

Printer Interfaces

Printer interfaces available in software packages are often called *printer drivers* to reflect the fact that they drive, or command, the printer's built-in computer. Printer drivers do everything from simple character printing to using whatever print enhancement and formatting features your printer has available.

If you've been keeping up with the Intelligent Printer series, you're quite familiar with how the PC uses printer command sequences to induce your printer's built-in computer to print both ordinary and uncommon characters. You also may have organized your printer's features into a handy printer reference card that lists these features by functional area. You probably have tried out some of these features, with the help of Basic.

Some printer drivers use your printer's intelligence in the same way as you've learned to do in Basic, but others do not; there are actually several methods used for programming a software package to use or simulate printer features.

The printer drivers available in software packages use printer intelligence in one of three ways: the standard printer method, the enhanced standard printer method (intelligent printer simulation), and the intelligent printer method. Some software packages offer you alternative ways of using your printer, but most use just one method.

Standard Printer Method. Some software assumes that your printer isn't much more than a typewriter attached to your computer and limits its use of the printer's intelligence to printing individual characters (including spaces, carriage returns, and line feeds). Some of these packages assume that the printer can also do form feeds, but others just issue enough line feed command sequences to feed in a new page of paper.

Enhanced Standard Printer Method (Intelligent Printer Simulation). Software that uses the enhanced standard printer method assumes that your printer has no special features but acknowledges that it can do such things as backspacing and reprinting entire lines. Such software uses the backspacing and line reprinting capabilities of your printer to simulate intelligent print enhancement and formatting features.

For example, using the intelligent printer simulation approach, a software package might achieve boldface by repeating the printing of a group of characters and underlining by moving the carriage back and printing an underscore character (ASCII sequence number 095); these are the same techniques you might use on an ordinary office typewriter. The reprinting of an entire line, incidentally, is usually done by means of a carriage return issued without a line feed.

Intelligent Printer Method. Many software packages written in the last couple of years take advantage of printer intelligence by using the programmable print enhancement and formatting features found in the newer printers. These programs do their work in much the same way as we've been doing from Basic throughout this series.

Print enhancements are taken care of in the printer's software, rather than in the application software. This results in the smoothest possible cooperation between your PC and printer and the best possible use of your printer's features. The reason you get optimal use of your printer's features is that the printer's designers—who have a much more exact idea of how the printer works than do the people who wrote the application software— determine how a feature is implemented on the machine.

In addition to its numerous other advantages, the intelligent printer method usually makes for much faster printing. For example, under the intelligent printer simulation method, the printer usually has to make two passes across lines that have bold or underscored characters—one

Missing an installment of "The Printed Word"? All back issues of the column—from August 1983— are still available; for further information, see page 4.

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- All constants
- All reserved words (optional)

MINIATURE FULL SCREEN EDITOR

This utility program will allow you to enter up to twenty-four lines of text. This is a full screen editor and all cursor control keys are available for use. It will be most usefull for creating CRT displays and for creating 'batch command files.'

BASIC PROGRAM LISTING UTILITY

This utility program will create a 'fancy' listing onto the printer. It will print any file on the disk which is stored in ASCII format. The following will be printed at the top of each page:

- Header line of your choice
- Page number
- Date
- Program file name

'LINE DRAWING' BASIC SUBROUTINE

The subroutine provides a simple way to draw:

- A rectangle
- A verticle line (with or without 'T' ends)
- A horizontal line (with or without 'T' ends)
- Lines may be either single or double lines

'INPUT', 'MESSAGE', & 'CHANGE' BASIC SUBROUTINE

The 'input' subroutine will allow you to specify the length of input, type of input and redisplay format. The following types may be specified. Error checking is done on a character by character basis:

- Any ASCII character
- Only numbers
- A phone number
- A date as 'mm/dd/yy'
- A social security number
- A yes/no entry

The 'message' subroutine will display a use specified message on the 24th line and return the cursor to its original position.

The 'change' subroutine will allow you to enter a number of a field on the screen to be changed.

RANDOM FILE SEARCH SUBROUTINE

Subroutine performs a binary and sequential search for a given key:

- Fast typical search time 1 second
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- Any size record length

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STRING HANDLING SUBROUTINES:

- Sort array in memory
- Convert to uppercase
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- Unpack a RADIX to ASCII
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ordinary pass and a return pass with the printing mechanism in a slightly different position. Printer drivers using the intelligent printer method can achieve these special effects in a single pass.

The methods that take advantage of printer intelligence give you the best access to your printer's features and actually make better use of your PC, because the printer's computer does all the work associated with print enhancement and formatting, rather than burdening your PC with the job. We'll try to concentrate here on software packages that take advantage of printer intelligence, but we'll be looking at the other methods as well. Several approaches to using intelligent printer features are available, and they're all widely used. We'll examine them briefly and look over at least one example of each as we move along.

Configuring for a Fixed Number of Printers. The first of the more flexible methods software vendors use to make their software work with your printer is to supply you with a configuration program in which you specify your printer's make and model. The software package takes over from there; it specifies which print enhancement and other options your printer has available and determines how they are used in the printer you have. The biggest advantage of this method is that the burden of understanding how your printer is programmed and what its command sequences are is on the software vendor, not on you; you have to know only the make and model of your printer.

Software taking this approach commonly comes with print enhancement commands that enable and disable the printer features. You select features by embedding the enhancement commands within a document with the help of function or other keys (usually in conjunction with the control or alt key). Word processing packages often employ screen-enhancement techniques that show you which print enhancements you've selected in your text (for example, a word you want bold will appear brighter on the screen or phrases you want underscored will appear underlined).

There are two disadvantages to this method. The first and major one is that the software package may not support your printer; as a result, you won't be able to use its features with the package. With so many PC-compatible printers on the market, it's quite possible you'll find yourself in this situation.

The other disadvantage is that you may not like the way the vendor has implemented a particular feature for your printer, but you'll be stuck with the implementation. For example, the vendor may specify that your Epson printer print boldface by using the double-strike feature and perhaps you'd rather do it with the emphasized feature.

Other methods for taking advantage of your printer's intelligence are usually even more flexible, because they allow you to control the command sequences that enable your printer's features. Their disadvantage, of course, is that you are required to understand how to program your printer and how its command sequences are best used. Regular readers of this column, however, shouldn't have any trouble on that account.

Utility Setup Programs. The simplest of the other methods that allow you to control command sequences requires that you run a printer setup utility program prior to using the software package for the first time. Some vendors supply this kind of utility with their packages; standalone printer utility products are also available to do the job. These utilities are especially handy for software packages that don't take any advantage of printer intelligence, and the standalone ones are invaluable if a package's vendor doesn't supply a printer utility. (Note that printer utilities supplied with some software packages will work with others you're using as well.)

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All you have to do is run the printer utility and use it to enable one or more features, such as bold or underlined printing, and then exit from the utility and run the software package. Your printed output will be produced using whatever features you have enabled with the utility.

These utilities generally are easy to use, but they have a major shortcoming: If you want to have different types of printing in various places throughout your report, you're out of luck. Whatever feature or features you enabled before you started will be with you for the duration of your printout. Another difficulty is that certain printer features stay in effect for only one line of printing (the *wide* command sequence for the Epson printer that we've been using as an example in this column is a case in point, although this restriction has been altered in later Epson models). If you enable a feature restricted in this manner, it will last for only the first line of your output.

One last objection is that some people don't like to run a separate program to access printer features, even though doing so may be better than having no access at all.

Command Sequence Insertion. Another method, which is often used in word processors and text editors, lets you insert printer command sequences directly into your text wherever you want to enable or disable a feature. Some such packages use a special character or character sequence, followed by the ASCII numbers of the command sequences you wish to use; with others, you type in the command sequences (including the escape character) required to enable the printer feature you want.

This method isn't difficult, but it has two drawbacks. In some cases the paragraph formatting, or reflow, program doesn't work correctly when printer command sequences are inserted into the text. The format routine assumes that the command sequences, along with any special characters required, are ordinary characters that must be pushed into shape. If you're always in a situation where a line format or print enhancement can be enabled or disabled between paragraphs, or if you're producing some kind of chart or table where paragraph formatting isn't important, this may not be much of a problem.

The major disadvantage of this method is that you may have to stop and look up a command sequence each time you want to use it. If you've made a printer reference card for your printer, this isn't hard, but if you do a lot of word processing it can still be annoying.

Command Sequence Tables. By far the best printer-driver method is one that uses a table of printer command sequences that you supply. This method is based on the standard programming technique of using data tables to describe something.

The tables in table-driven printer drivers describe the printer command sequences you want the software package to use to enable or disable printer features. To take an example from our MX-80 printer, you may wish to implement bold printing with double strike, emphasized, or both features; or you may not want to implement it at all. The choice is yours.

Once the data tables have been loaded, you use the software package's print enhancement commands to enable and disable the features. This is usually easier than entering the codes directly, because the commands are on a menu or use function or other keys.

Data tables are also commonly used in software packages that support a fixed set of printers, but these packages don't allow you to control the data in the tables. User-supplied table-driven printer drivers let you supply the data and use your printer's features any way you like. Also, packages employing this method work with just about any printer that can be attached to your PC, even printers that the package's authors have never heard of.

The PFS Series. We'll start our survey of printer drivers by looking at Software Publishing Corporation's PFS series, which includes *PFS:File*, *PFS:Report*, and *PFS:Write*. All these programs are highly rated for their ease of use and functionality.

How does the PFS series apply printer intelligence? Is using your printer's features with PFS products as easy as using the products themselves? Let's see.

File and *Report* are delivered with a printer setup utility, named Printer, that you have to run before you use the programs; Printer can also be used prior to running most other PC programs.

After you start running Printer, you specify the port (Lpt1:, Lpt2:, or whatever) to which your printer is attached. The PFS series is one of the few around that directly support use of a second or third printer (a topic we'll take up in a later column). Having specified a printer port, you're then presented with a screen on which to enter the command sequences for the printer features you want to use.

You may enter any command sequence by typing the required characters. The PFS Printer utility allows you to enter the escape character (which is why this program uses F6 to exit; other PFS programs use the escape key for that purpose). For "normal" characters (those with ASCII sequence numbers 032 and above), Printer displays the character associated with the ASCII sequence number you type; for the escape character, Printer displays the word "Escape", and for the other characters whose ASCII sequence numbers are less than 032, Printer displays the control-code names (see the February 1984 "Printed Word" for an explanation of control-code format).

When you're running Printer, you have to know exactly which codes to enter, so your printer reference card should come in handy. If you make a mistake, you can press F6 to leave Printer without sending any command sequences to your printer.

PFS:File and *PFS:Report* make no further assumptions about your printer's intelligence. Both programs use line feed command sequences (instead of form feeds) to start new pages, although both allow you to specify the number of lines you want printed per page. This can be

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difficult to determine if you've redefined your line height (you have to calculate the number of lines per eleven-inch page, for example).

PFS:Write is a different story. If you're a *File* or *Report* user, you can, if you wish, use the Printer utility with *PFS:Write* (it's not delivered with *Write*). But *Write* has a lot more to offer for making use of printer intelligence.

There are two ways to use *PFS:Write*'s printer driver. The authors provided reprinting facilities for underlining and boldfacing of your text, and they also made a provision for entering printer command sequences directly into the text of your document.

Write implements the reprint facility through two function keys. The F7 key underlines text (and displays an underscored character on the screen), and the F8 key makes the text boldfaced (and displays bright characters on the screen). Both keys do their work one character at a time, and you can't undo either feature without retyping the character.

At print time, the underlining does its job by reprinting the line with underscore characters beneath the characters you've asked to have underlined. Boldface printing is achieved by printing the characters two additional times. Thus, underlining requires one extra print pass for the line, and boldface requires two. The reprints for each feature aren't done on the same pass, so if you have both underlining and boldfacing in effect for a line, a total of four printing passes will be required.

PFS:Write gives you the alternative of using your printer's built-in features by entering the command sequences directly into the text. All you have to do is enter the command sequence between a character sequence that starts with "*P" and ends with "*". To enable emphasized printing on the MX-80, for instance, you insert:

P 27,69

at whatever point in your text you want that feature to start.

PFS:Write will correctly format your paragraph, but you have to be a little bit careful. Once you've used command-sequence insertion, what you see on your screen is no longer what you get from your printer. The screen display of the text will look as if it's been formatted for the extra characters required for the command sequence (and the *P), but the printed output will be formatted correctly, with no printable characters in those positions. There's no display enhancement when you're using this method, because *PFS:Write* hasn't any idea what you're doing with the "*P" insertions. (*PFS:Write* also uses the "*" format for other types of insertions.)

Some experimentation with your document's format may be required, especially if you're depending on page breaks to show up in a special place. While we're on the subject of page breaks, let's mention that *PFS:Write* doesn't use a form feed command sequence but depends on line feeds to start a new page.

Using your printer's intelligence with the PFS series of packages is, like working with the rest of the software produced by Software Publishing, simple but effective. You may not find the Printer utility approach satisfactory for all your reports but, where it will do the job, it's relatively easy to use. *PFS:Write*'s approach is more sophisticated, and it's easy to use as long as you understand your printer and you are willing to experiment with your document's format. In case you aren't, *PFS:Write* offers the reprint facility—which works well, although it's quite slow at its job.

Next month we'll take a look at *EasyWriterII*'s user-supplied printer table approach to a printer driver. While all such tables are excellent ways for a software package to use your printer's intelligence, Information Unlimited Software went out of its way to provide outstanding printer flexibility for its popular word processor.

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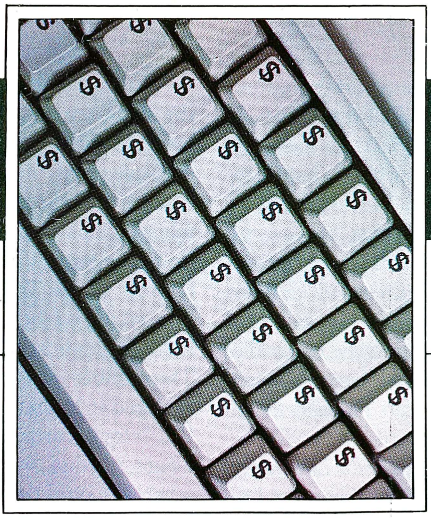

MICRO FINANCE

by Ken Landis and Mark Herbers

Linear Programming, Part II; *LPMaster*

Last month we looked into the basics of linear programming (LP)—what it is and how we set up a problem to be solved using it. This month, we'll consider the management issues involved in solving an LP problem and see how to resolve the problem we set up last month.

Our problem concerns a certain Tom Monk, the owner of a company that manufactures peripherals for the PC. Tom's task is to determine what the mix of clock and memory cards should be to maximize his firm's profits. This decision must be made immediately because the production run will start almost immediately and will go on for two days.

Of course, Tom is not working with unlimited resources. He has 1,600 labor hours and 1,800 processing hours. And he also has only sufficient parts on hand to make 350 memory cards. These are his *constraints*.

Tom's objective is to maximize his profit. He makes $3 for each clock card he produces, and $8 on each memory card. So why doesn't he just make memory cards? Because memory cards take four labor hours to produce, compared to two labor hours for clock cards. In addition, clock cards require six processing hours compared to two for memory cards. By determining the optimum number of each card to produce, Tom can maximize the use of all his resources and make the most possible money.

As we saw last time, the problem can be expressed mathematically as follows:

X_1 equals the optimum number of clock cards to be produced
X_2 equals the optimum number of memory cards to be produced

The objective function is maximize
$P = 3X_1 + 8X_2$
subject to the constraints
$2X_1 + 4X_2$ must be less than or equal to 1,600 (labor hours)
$6X_1 + 2X_2$ must be less than or equal to 1,800 (processing hours)
X_2 must be less than or equal to 350 (parts available for memory cards)
X_1 must be greater than or equal to 0 (no negative production)
X_2 must be greater than or equal to 0 (no negative production)

Once this problem has been solved using LP, Tom will know how many clock and memory cards to produce to maximize profit. He'll also know what his profit is and how many labor hours, processing, and RAM cards he used. What won't he know?

For starters, the solution to the problem doesn't tell Tom directly how many labor and processing hours he has used. He'll have to calculate them himself by "plugging" in the value of the optimum solution into his constraints. To find out how many labor hours or processing hours remain, he'll simply subtract the number used from the number available. But another way Tom can determine the number of hours left over is by simply adding another variable to the constraint, which then makes it an equation. This variable is called a *slack* variable. In Tom's problem, we'll call the slack variable for labor X_3 and the slack variable for processing X_4. When you add slack variables, you must add one for each constraint. Once these two slacks are added, the constraints look like this:

$2X_1 + 4X_2 + X_3$ must equal 1,600 (labor hours)
$6X_1 + 2X_2 + X_4$ must equal 1,800 (processing hours)
X_2 must equal 350 (parts available for memory cards)
X_1 must be greater than or equal 0 (no negative production)
X_2 must be greater than or equal 0 (no negative production)

When the LP problem is solved, the slacks will tell Tom how much excess capacity of labor and processing hours he has. Knowing exactly what his excess capacity is gives Tom the option to direct these leftover hours to other products, ask his people to take vacation, or offer his people time off. The key point is that he knows exactly what he needs to get the job done.

There's one more question Tom would like answered. How many of the RAM cards will he have when production is completed? They are difficult to come by and must be ordered in advance. To find the answer to this question, he simply adds another slack variable, X_5 to the third constraint.

Tom is now ready to solve the LP problem. He has two choices: He can solve it manually, using a method known as the *simplex tableau*, or he can use a piece of software. For the convenience of this column, we'll assume he takes the latter approach, and we'll assume furthermore that he uses a program called *LPMaster* (Applied Operations Research, Canoga Park, California).

The simplex tableau is an iterative LP-solving technique. To solve the problem manually, Tom would probably have to complete five to ten iterations, or runs, through the problem. Each time he would have to substitute values for the variables and solve the equations simultaneously. This process is time-consuming; it involves matrix mathematics, and, because of the number of steps involved, people tend to make errors doing it.

His alternative, using *LPMaster*, is far more efficacious; it will allow him to solve the problem correctly in a fraction of the time it would take him to do it manually.

In the world of linear programming, Tom's problem is relatively simple. LP problems can involve hundreds of variables and thousands of constraints. Attempting to solve one of these more complex problems manually is tantamount to committing mathematical suicide. Yet problems of this size are commonly found in business; when a piece of software like *LPMaster* is used, elaborate problems become as easy to solve as the simple ones.

LPMaster, and programs like it, are designed for managers who understand what LP can do but don't have the time or energy to solve the problem manually—or to use a batch-oriented mainframe system.

Using *LPMaster* requires Tom to structure his problem. He did this when he designed the objective function and constraints last month.

Now, however, these equations have to be transformed into a format *LPMaster* can understand. The process is logical in nature rather than mathematical.

Figure 1 shows the *LPMaster* input file. This file stores all the information needed to solve the LP problem. It can be created using any text editor or word processor that can deliver a standard ASCII text file. The format of the stored information is determined by *LPMaster*.

The left-hand column headed by "Definitions" is called the *control card column*. Control cards are used by *LPMaster* to separate the various parts of the input file. For example, the information following Definitions defines the resources, sales locations, products, and so on needed to solve the problem. The Endef control card tells *LPMaster* that it has read all of the problem's definitions.

The Data control card starts the data section of the input file. All of the known information, such as gross profit, production costs, and so on, is entered here. This section is ended by the Endata control card.

LPMaster turns this raw information into a machine-solvable problem when it encounters the Compile control card. Once the compile is completed, the Solve command solves the problem. The Report control card instructs *LPMaster* to produce the report. After it has been processed, the user is asked where the report should be produced. The report can either be sent to a printer or viewed on the screen.

Let's look under the Definitions control card at the heading card Resources. When Tom designed his input file, he had to assign two-character names to each resource. For example, he used HR for labor hours. In *LPMaster* the HR is called a *description card*. It defines and describes a variable to the program. The "labor hours" description that appears to the right of HR is a comment field. Up to sixteen characters of the variable can be entered to document the input file.

In the Data section, Tom tells *LPMaster* what the mathematical relationships are between the products and his profit. Under Sales by Location, MC is the gross profit on memory cards, CC is the gross profit on clock cards. This information is taken directly from Tom's original equations. Tom could just as easily have incorporated all of his revenue and profit information into the model and let *LPMaster* perform all the calculations—such as determining gross profit. In his case, the gross profit information was easier to get than all of his raw numbers.

The more information Tom wants to incorporate into the model, the more complex the model becomes and the longer it takes to build. Therefore he has done certain simple calculations himself to make the model easier to build.

```
TITLE
                  IBM PC PERIPHERAL PRODUCTION PROBLEM
DEFINITION
RESOURCES
                    HR       LABOR HOURS
                    PH       PROCESS HOURS
                    RM       RAMS
SALES LOCATIONS
                    LA       LOCAL AREA
PRODUCTS
                    MC       MEMORY CARDS
                    CC       CLOCK CARDS
ENDEF
DATA
SALES BY LOCATION
                                  LA
                    MC          8.00   $/MEMORY CARD
                    CC          3.00   $/CLOCK CARD
TRANSFERS
                             MC         CC
                    HR       -4         -2
                    PH       -2         -6
                    RM       -1
LIMITS
                   MAX       MIN        FIX
         HRBUYMAT  1600                            LABOR HOUR LIMIT
         PHBUYMAT  1800                            PROCESS HOUR LIMIT
         RMBUYMAT   350                            RAM LIMIT
ENDATA
COMPILE
SOLVE
REPORT
```

Figure 1.

The Transfers section tells *LPMaster* what the resource requirements are to build the memory cards (MC) and clock cards (CC). For example, from Tom's equations we know that it takes four hours to build a memory card, while a clock card requires two. This information is entered via a simple matrix. Refer to figure 1 under Transfers. Looking at the first line, which is labor hours (HR), we see that the first column is headed MC, for memory cards. The number -4 represents the four labor hours required to build a memory card. The -2 under CC (clock cards) represents the two labor hours needed to build a clock card. This scheme is used throughout *LPMaster* to show the relationships between resources and products.

The next section, Limits, tells *LPMaster* the constraints Tom faces on resources. As we already know from his equations, he can use a maximum of 1,600 labor hours, 1,800 processing hours, and 350 RAM cards over the next two days.

HRBuymat tells *LPMaster* the maximum number of labor hours Tom can buy (or have) over the next two days. Buymat stands for *buy materials*. *LPMaster* understands three other types of limits—a sales limit (Sell), a transportation limit (Ship), and a production limit (Manufc). In Tom's example we used a resource limit, RMBuymat. Tom could have specified it as RMManufc and achieved the same result, because RAMs are used only to manufacture memory cards.

As you can see, the matrix setup is used again to define the maximum available, the minimum available, and the required number or amount of a resource or product that must be used. In *LPMaster* these are referred to as Max, Min and Fix.

At this point, Tom has entered all of the information *LPMaster* needs to solve his problem. Once the remaining control cards, Compile, Solve, and Report, have been added, the file is in a format *LPMaster* can use.

Tom simply starts up *LPMaster*, tells it the name of his input file, and hits the enter key. *LPMaster* then reads the input file, digests the information it contains, and solves the problem. Figure 2 is the report that shows Tom his optimum solution.

The Overall Economic Summary tells Tom that the maximum profit he can make on this production run is $3,100, based upon the LP problem he has fed *LPMaster*. If he had assigned costs to his resources and selling prices to his products rather than using gross profit, *LPMaster* would have calculated the total revenue and cost of goods available for sale for his run. Tom could have broken out his costs into resources (raw materials), production costs (labor hours, machine costs), and transportation costs (delivery charges). The end result would have been the same but it would have made available more information on how to manage his business.

To reach this optimum gross profit, Tom has to follow the guidelines set out under the Optimal Plant Operation, Sales by Location section. He must produce 350 memory cards and 100 clock cards. Any other combination of products will yield a lower gross profit. In Tom's case the title Sales by Location may be misleading. To *LPMaster* it can mean either sales or production.

Answering some of Tom's questions about how many labor and processing hours were used and unused, *LPMaster* shows the maximum/minimum/fixed amount defined in the input file and the actual quantity used in the resource consumption section. The Amount column shows the actual quantity used to achieve the optimum solution. The upper-limit section is taken directly from the input file.

Look at Process Hours. Tom has 1,800 hours available but needs only 1,300. He can use the 500 extra hours on other products. If he didn't have this information, he would not know how many excess hours (how much slack) he had until after he completed production, and that would have been too late.

To solve Tom's problem manually, we would have had to add one more variable for each resource in the problem to find out the amount of slack, if any, for each resource. In *LPMaster* slack is found by subtracting the amount of each resource used from the quantity available.

The last column in this section, Incentive, is fascinating. This is what's known as the *shadow price*. What's a shadow price? Let's use labor hours as an example. Tom has 1,600 hours available, and he needs all 1,600 to reach the maximum profit of $3,100. The $1.50 incentive, or shadow price, tells Tom that if he could get one more labor hour, his gross profit would increase by $1.50. So, if he could buy an additional labor hour for $1.00 over his current labor cost per hour, his gross profit would increase $.50.

With this information, Tom can easily decide whether it's profitable to pay overtime or hire more people. The same holds true for RAMs. However, if Tom adds one more RAM, he will also have to add at least one more labor hour. Why? Because he has no excess labor hours to produce another memory card. To find out if this is profitable, Tom would add together the shadow prices for labor hours and RAMs, which would be $3.50, and subtract the additional costs. If the number is positive, then Tom should try to buy the additional resources. If the number is negative, then he would lose money.

Notice that process hours does not have a shadow price. Actually, the shadow price is negative. If Tom uses more than the 1,300 hours required, he'll spend more than he has to and his gross profit will go down.

In Tom's case, the last section, Production Rates, is the same as Sales by Location. If Tom had faced transportation costs, multiple selling locations, and so on, then it's likely that the optimum number of cards produced would not equal the number sold. Tom's case is a very simple one. In real life, these other costs would have been incorporated into the model.

Learning to use *LPMaster* should take an experienced user about five hours. Building Tom's model took approximately forty minutes. Solving and printing it using *LPMaster* took seventy-six seconds. Solving it manually took two MBAs fifteen minutes (if you're not an MBA, it might not take as long; they tend to look for questions that aren't there).

As we've said, Tom's problem is simple. Real LP problems may have hundreds of variables and constraints, multiple cost structures, process-dependent products, multiple sales locations, distribution and delivery costs, and so on. *LPMaster* can probably handle any size problem you face. Typical uses of LP in the business world include product planning, production scheduling, product mix and fluid blending determination, portfolio management, and many others. Any problem where the answer should be either a maximum or minimum value lends itself to solution by LP. ▲

Mark C. Herbers is a senior consultant with the St. Louis office of Peat, Marwick, Mitchell & Co.

```
                    IBM PC PERIPHERAL PRODUCTION PROBLEM
                       OVERALL ECONOMIC SUMMARY:
                         SALES                  $          3100.0
                         CONSUMPTIONS           $             0.0
                         PRODUCTION COSTS       $             0.0
                         TRANSPORTATION COSTS $               0.0
                                 GROSS PROFIT   $          3100.0

                       OPTIMAL PLANT OPERATION:
SALES BY LOCATION ------------
                                               UPPER       LOWER
  PRODUCT        LOCATION          AMOUNT      LIMIT       LIMIT      INCENTIVE

    MEMORY CARDS  LOCAL AREA        350.0
    CLOCK CARDS   LOCAL AREA        100.0
RESOURCE CONSUMPTIONS --------
                                               UPPER       LOWER
                                   AMOUNT      LIMIT       LIMIT      INCENTIVE

  LABOR HOURS                      1600.0      1600.0                   1.50
  PROCESS HOURS                    1300.0      1800.0
  RAMS                              350.0       350.0                   2.00
                                               UPPER       LOWER
                                   AMOUNT      LIMIT       LIMIT      INCENTIVE

PRODUCTION RATES ------------

    MEMORY CARDS                    350.0
    CLOCK CARDS                     100.0

                            END JOB  23:48:04
```

Figure 2.

PC RESET

The button that IBM left out

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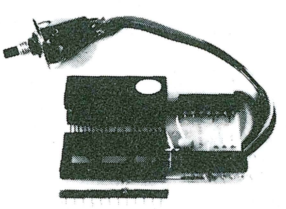

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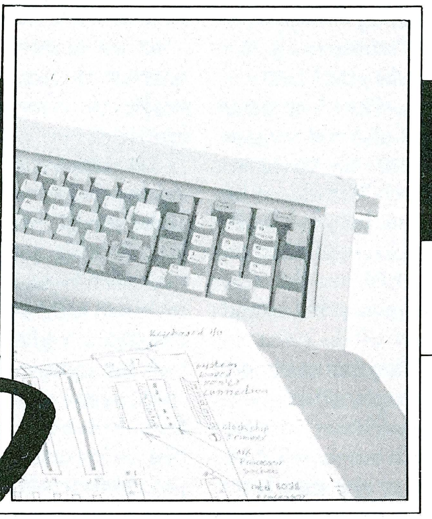

SYSTEM Notebook

by Alan Boyd

Installable Device Drivers; an Introduction to Ansi.sys

DOS 2's installable device drivers are a relatively new feature in microcomputer operating systems. Previous generations of operating systems (including PC-DOS version 1) interfaced peripherals through the Basic Input/Output System (BIOS) routines. The drawback of that approach was that the operating system itself had to be customized for each particular hardware configuration. Problems arose when two or more peripheral devices modified the same part of the BIOS. To untangle the mayhem, DOS 2.0 provided for installable device drivers; these allow the user to attach "foreign" (non-IBM) hardware devices to the PC and make them work with DOS as though they were standard elements of the system.

The provision for device drivers allows software developers to write code for what are known as *logical* devices. Logical devices are not real devices at all, but rather a set of rules that govern the input and output to and from a class of peripherals. The actual peripheral (the *physical* device as opposed to the logical one) is attached to the operating system software via a device driver, which is customized to suit the idiosyncrasies of the hardware design in question. As a result of this arrangement, a developer of application software doesn't have to worry too much about the characteristics of each printer or each plotter on the market; instead he can concentrate on developing simple device commands, letting the hardware manufacturers' device drivers take care of the nitty-gritty.

At first it might seem as though device drivers are of interest only to hardware manufacturers. But, as it turns out, there are other uses for device drivers that make them valuable to anyone who can master their syntax.

In March's "System Notebook" you learned that you could add a new device driver to your system by putting a simple statement in a file called Config.sys. But there we only alluded to the range of devices that could be attached.

One generally thinks of the term *devices* in connection with peripheral items that attach to the computer by way of serial or parallel interfaces—printers and modems, for example. However, there are other types of devices—devices that have no external hardware component—that also work with DOS. These are the immediately obvious input and output components of your system—the keyboard, video screen, and I/O ports. The operating system comes with standard drivers for communicating with these devices; it also provides reserved names for the devices themselves—Lpt1:, Com1:, Con:, and so on. One of the little-known facts about DOS 2 is that it permits you to replace these standard device drivers with your own customized drivers.

The best example of this facility is the Ansi.sys device driver shipped with DOS 2. By installing this driver into your system, you can reconfigure each of the elements of the Con: device—the keyboard and the screen. If you don't like the way a function key works, you can redefine it. If you don't like the way the PC keyboard is arranged, you can rearrange it yourself. DOS supplies all the tools. We'll discuss how to go about this next month; now let's take a look at the background and workings of the Ansi.sys driver.

The Ansi.sys driver gets its name from the American National Standards Institute (ANSI), which defined a standard method whereby certain terminal characteristics could be controlled in a somewhat cohesive manner. This effort at standardization was a reaction to the many types of intelligent terminals—IBM 3101, DEC VT100, DEC VT52, and so on—that were appearing on the market. It was an attempt to simplify the job of software developers by supplying a common set of rules that could be applied to any terminal.

Unfortunately, Ansi.sys met the same fate that many other committee-derived (nondefacto) standards have met. The goals of the committee and those of private industry were two different things, and the idea of making each manufacturer's device behave like those of every other manufacturer flew in the face of free enterprise. In short, very few terminals are fully Ansi-standard (the one that conforms most closely to the Ansi standard is Digital Equipment Corporation's VT-100).

The central concern of the ANSI committee was to define codes—in addition to the standard ASCII control codes—that could be used to govern cursor positioning and other terminal characteristics.

As you may know, ASCII is a code that provides for the translation of all the standard alphanumeric characters into a binary numeric form for storage and manipulation by the computer. In binary notation, seven bits can represent any of 128 different values (two to the seventh power), and that's more than ample for encoding the ninety-six standard alphanumeric characters (twenty-six lowercase letters, twenty-six capitals, ten numerals, and a handful of punctuation symbols). So "normal" ASCII (normal, as distinguished from IBM's extended ASCII) is a seven-bit code. In addition to the ninety-six alphanumerics, ASCII provides for thirty-two "control" characters; these include such things as carriage return, line feed, tab, and so on.

Control characters can be used in all kinds of ways, but generally their function is to provide commands, as opposed to data, to peripheral devices (that distinction is artificial, but it'll serve for present purposes). A carriage return character, for example, tells a printer or terminal to move the printhead or cursor back to the beginning of the current line; a tab character tells a device to move to the next preestablished tab position, and so on.

Thirty-two characters make a pretty limited repertoire. The current generation of printers, for example, requires a much more extensive command syntax than can be provided by those thirty-two—and so do all CRT terminals. The ANSI committee was attempting to provide a standard syntax for terminals that would cover such ground as telling a terminal where to put a character, whether or not to highlight a character, what color to display a character in, and so on.

The method they followed was to select a single ASCII character for use as a command precedent. When a terminal detected this code, then, it would know that the next sequence of characters was not data for display but rather a command of some sort. This simple decision made it possible to have an arbitrary number of characters and codes while remaining in a seven-bit ASCII context.

The character they selected was the escape character, whose ASCII value is 27. A portion of the coding language established by the ANSI committee is available to you as the DOS device driver Ansi.sys.

To use the Ansi.sys facility, you must first "install" this device driver. You do this by creating a file called Config.sys (or modifying that file if it already exists) and placing it on the disk you use to boot your system. You also have to put a copy of the file Ansi.sys on your boot disk. Your Config.sys file needs to contain the line

```
DEVICE=ANSI.SYS
```

That's all there is to it. Whenever you boot your system using a boot disk that contains a Config.sys file that includes this instruction, DOS will replace the normal console driver with the installable device driver Ansi.sys.

(If you wish to try out the examples that follow, you'll need to install Ansi.sys now; be sure to reboot your system after you've created your Config.sys file, and don't forget to put Ansi.sys itself on your boot disk, along with the Config.sys file.)

There are four classes of commands that can be interpreted and executed by the Ansi driver. These are cursor control, erasing, mode of operation/attribute setting, and key reassignment. We'll examine each of these in turn (we won't get through all of them this time) and provide some examples of how you can use them.

First, however, we need a method of sending commands to the Ansi driver. The problem is that all the Ansi commands start with the escape character and you have to resort to some special tactics to send an escape character to the console. You might think that you could just use the *copy con: filename* method of creating a text file, then send the contents of that file to the console by means of the *type* command. Not so. If you hit the escape key while creating a file by way of *copy con:*, DOS simply cancels the line of your file that contains the escape character; in other words, it excludes that line from the file.

One way to put an escape character into a text file is to use the Debug program supplied with DOS (Debug.com), but there's a simpler way that we'll use here to exemplify some of the Ansi commands. Our simpler method is to use the DOS *prompt* command.

If you're rusty on the *prompt* command, you may want to look back to the December 1983 installment of this column. Or see pages 10-18 to 10-20 of the DOS 2 manual. Here's a quick refresher, in any case.

You may remember that the command

```
PROMPT Yes?
```

results in the replacement of the normal DOS A⟩ prompt with Yes?. You may also recall that the special character *$*, when used in a *prompt* command, has a special meaning. The dollar sign lets you put various "meta-strings" into your *prompt* command. *$t*, for example, puts the system time into your prompt; *$d* gets the system date, and so on.

Last December, our original discussion of the *prompt* command mentioned that *$e* serves to put the escape character into the prompt string. But we didn't mention any use for this character. We'll remedy that now. The *prompt* command, of course, causes a string of characters to be sent to the screen—and hence to any device driver that replaces the standard console device. So this command will enable us to send escape sequences to the Ansi driver.

The first example of the use of the Ansi.sys driver that we'll look at provides quite a dramatic example of the use of Ansi.sys. It uses one of the two Ansi.sys erasing sequences.

Enter the following command exactly as shown:

```
PROMPT $e[2J
```

and press return. Be sure the *e* is lower case and the *J* is upper. (Incidentally, you don't have to have a copy of the *prompt* command on your disk; the DOS 2 manual claims that *prompt* is an external command, but in fact it's built into the command processor—in other words, it's an internal command.) Don't worry about what each of the elements stands for; we'll come back to that later.

The screen should at this point go completely blank except for a flashing underline character at the top left corner of the screen. Now issue a *dir* command and note the result. The DOS directory is listed, but the screen goes blank again and the cursor returns to the top of the screen as soon as the listing has been displayed.

What's happened is that you've changed the DOS prompt from the usual A⟩ to an abstraction that begins with an escape character. Therefore, every time DOS throws the prompt up on the screen, what it's actually doing is sending an escape sequence to the Ansi.sys device driver. This particular escape sequence erases the screen and returns the cursor to the home position, the top left corner of the screen.

This prompt is a simple demonstration of what happens when the Ansi.sys driver receives a command, but it serves no useful purpose—it doesn't make much sense to have the screen go blank every time the prompt is printed. This escape sequence would not ordinarily come from inside the prompt but would most likely be sent to the screen by a program. Just as a program can make the beeper beep by sending a control-G to the screen, it can also erase the screen and return the cursor to the home position by sending out the sequence *⟨escape⟩[2J.*

Now to the formidable task of explaining the Ansi command format. Fortunately, the Ansi.sys driver doesn't implement the entire Ansi specification. However, it does follow Ansi specs closely enough that

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some sort of explanation of the Ansi standard format is in order.

The Ansi standard was deliberately designed to be as open-ended as possible, which allows many different sets of escape sequences to be used. Therefore, a character was needed to define the particular set that we use on the PC. This character is *[*, the left square bracket. All the escape sequences used by the Ansi.sys driver begin with *⟨escape⟩[*.

After these lead-in characters there follow first the parameters of the Ansi command and then a character that identifies the command itself. This format may seem quite confusing; however, when it's taken in the context of the full Ansi standard, some semblance of order appears.

Cursor Control. There are a total of ten Ansi escape sequences that can be used for cursor control, two of which are functionally identical. The first of these—the horizontal and vertical position (HVP) command—is used to position the cursor at a specified position on the screen. Its format is:

```
⟨escape⟩[#;#f
```

where the first and second number signs represent the vertical and horizontal positions respectively.

If, for instance, you want the cursor to go to the end position (the beginning of the last line on the screen) every time a DOS command is issued and completed on, you can enter the command

```
PROMPT $e[25;1f
```

This positions the cursor in the first column position on the twenty-fifth screen line.

This command is functionally identical to the cursor position (CUP) command, which has the format

```
⟨escape⟩[#;#H
```

In either the HVP or CUP command, the default value for a numeric parameter is 1. Therefore, if neither of the numeric parameters is specified, the cursor returns to the home position.

The next four Ansi escape sequences are all related. They are cursor up (CUU), cursor down (CUD), cursor forward (CUF), and cursor backward (CUB). The formats they use are

Cursor Up	**⟨escape⟩[#A**
Cursor Down	**⟨escape⟩[#B**
Cursor Forward	**⟨escape⟩[#C**
Cursor Backward	**⟨escape⟩[#D**

(In each case the number sign represents a user-specified number.)

The CUU command moves the position of the cursor up from its current position by the number of rows specified by the number sign. If the number-sign parameter isn't included, then the default is 1. Obviously, when it reaches the top of the screen, the cursor goes no farther; so if the number-sign parameter specifies a larger number of rows than is available, the excess is ignored.

CUD does exactly the opposite of CUP: It moves the cursor down the screen a specified number of rows, until it reaches the bottom of the screen. Again, the default is 1.

The CUF command does exactly as you would expect—it shifts the cursor a specified number of columns to the right of its current position, until it reaches the rightmost column of the screen. And CUB, the antithesis of the CUF, moves the cursor a specified number of columns to the left.

These four Ansi escape sequences are a boon to anyone writing screen-intensive software. The one drawback to the use of these sequences is that they are relatively slow in execution, compared to direct screen addressing. However, the major benefit of portability across several different manufacturers' computers in many cases outweighs this problem.

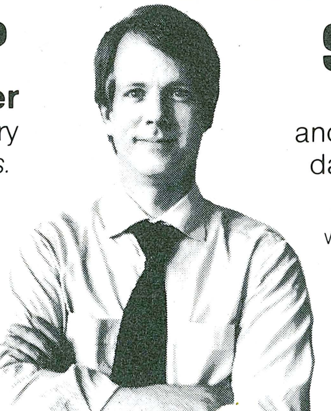
The next pair of Ansi escape sequences are what are known as the device-status report (DSR) and the cursor-position report (CPR). These two escape sequences are a matched pair; when a program sends the Ansi.sys driver a device-status report, the driver sends back a cursor-position report.

We can demonstrate this easily using our *prompt* command again, but you should be forewarned that this example will cause your PC to go into a loop from which you can exit only by rebooting. We will turn the DOS prompt into a device-status report so that every time the prompt is sent to the screen the Ansi.sys driver will respond by sending back a cursor-position report. When the CPR has been received, the prompt will again be thrown up on the screen, again sending out a DSR and requesting Ansi.sys to send back a CPR. Meanwhile, the cursor position will move down the screen, causing a different CPR to be sent back with each iteration—until the cursor gets to the bottom line.

Try the following to see the results for yourself. Since it will scroll down the screen so quickly, you may first want to turn on your printer so that you can capture the screen output. Whenever you have seen enough, reboot your computer.

First of all, erase the screen and return the cursor to home by typing the DOS *cls* command. In Ansi terms, the cursor is now in row 1. Then issue the following command, which sends the Ansi escape sequence for a device-status report to the Ansi.sys device driver

```
PROMPT $e[6n
```



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DOS 2.10!

You should immediately notice that a stream of characters appears on the screen, rapidly scrolling downward. If you capture these characters, you'll find that they look like this:

```
    \
    [04;01R
    \
    [06;01R
    \
    [08;01R
    \
    [10;01R
```

and so on, until they stabilize at

```
    \
    [25;01R
    \
    [25;01R
```

The CPR comes back in the form

⟨escape⟩[#;#R

where the first number sign represents the row number and the second number sign stands for the column number of the current cursor position. Of course, if you try to type an escape character at the command line, DOS will issue a backslash character (\ ) and issue a line feed to drop the cursor position to the next line. So much for this rather bizarre example.

The DSR/CPR combination is handy for writing software where the current cursor position is not known. A program can learn the coordinates of the cursor by sending out a DSR; Ansi.sys responds by sending the cursor position back in a CPR. Since this information is sent back through the standard device—in this case the screen—it can be filtered or redirected at will.

The last pair of escape sequences in the cursor positioning group are another matched pair—this time known as the save cursor position (SCP) and restore cursor position (RCP) sequences.

When an SCP sequence is sent to Ansi.sys, the current position of the cursor is saved in a special location. If, at a later time, you want to return the cursor to those coordinates, you simply issue a restore cursor position sequence.

The save cursor position escape sequence is

⟨escape⟩[s

and the restore cursor position escape sequence is

⟨escape⟩[u

This combination is really handy in situations where a screen has to be abandoned—say, to bring up some help information—and subsequently re-created.

The last set of Ansi escape sequences we'll look at this month are the two erasing sequences. The first of these, the one we explored earlier in this column, is called—what else?—the erase-in-display (ED) sequence. It clears the screen and sends the cursor to the home position, so its effect is more or less the same as that of the DOS *cls* command. As we saw earlier, the format of this escape sequence is

⟨escape⟩[2J

The companion escape sequence is the erase-in-line (EL) sequence, which simply erases from the cursor position to the end of the line. This sequence takes the form

⟨escape⟩[k

These functions—positioning the cursor on the screen; moving it backward, forward, up, and down; deleting the screen and homing the cursor; deleting to the end of a line; saving and restoring the cursor position; and having the system tell you where the cursor is—are all of the basic functions required in screen editing. By making use of them from within a program, you could build a rudimentary text editor. Although such an editor would not be very fast, it would be small indeed. It would also be portable to other machines with Ansi capabilities. ▲

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Volume III Issue I **June 1984** **Softalk**

A Peachtree Grows in Manhattan (and Santa Monica)

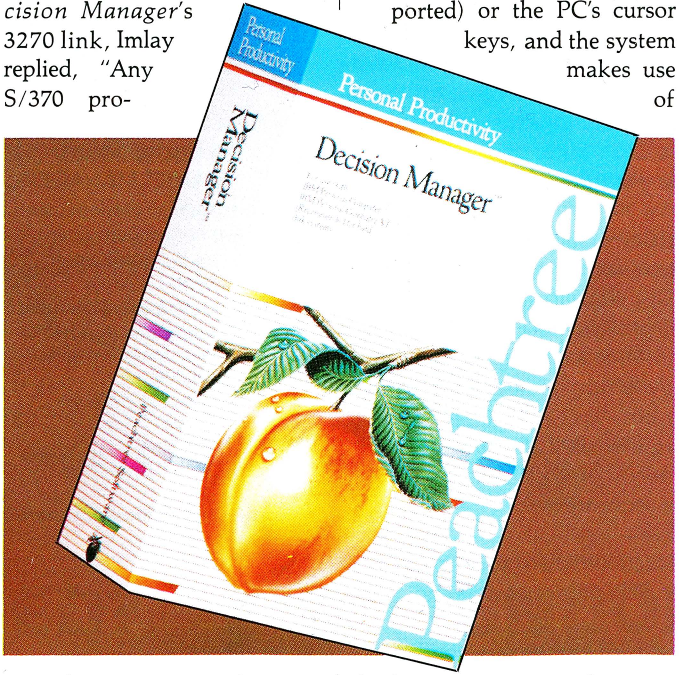
NEW YORK—On April 26, during press conferences held simultaneously at Manhattan's Helmsley Palace and the Miramar Hotel in Santa Monica, California, MSA/Peachtree announced a gaggle of new software products for a wide variety of personal computers. The twenty-five new products from the Atlanta, Georgia, company are targeted at the home, educational, and business marketplaces.

It wasn't much of a surprise that the flagship product of the new line is *Decision Manager*, Peachtree's version of an integrated product for the IBM PC that includes spreadsheet, word processing, and database capabilities. "And, oh yes," quipped MSA chairman John Imlay, "it has windows, too."

Peachtree's approach to product integration has an unusual twist or two. *Decision Manager* includes a small version of the *PeachText 5000* word processing system designed to allow a *Decision Manager* user to write a draft report. Files are fully compatible with the full-fledged word processing product, allowing an administrative staff person to put finishing touches on the report using *PeachText 5000*'s spelling checker, the Random House electronic thesaurus, and the *PeachText* print formatting program.

Also included in *Decision Manager* is IBM 3270 terminal emulation, which permits users to communicate directly with IBM mainframes via existing bisynchronous corporate networks. Asynchronous communication capability is included as well. MSA's widely used S/370 mainframe accounting and financial products have been upgraded to adapt to the new micro environment.

When asked what other mainframe applications and products could be used with *Decision Manager*'s 3270 link, Imlay replied, "Any S/370 program that transmits its data to a 3270 terminal, and that's virtually all of them." The product has not yet been implemented on the 3270-PC, but Peachtree representatives at the news conference didn't think doing it would be a problem.



Decision Manager has the same type of screen and printer graphics available in competitive products but adds something new to the competitive mix by producing presentation-quality graphics on a variety of plotters. Corporate customers will welcome this trend because graphics produced by computer printers often end up being transcribed to other media by art departments or vendors—a time-consuming and often expensive process.

Window movements can be accomplished using either a mouse (several models are supported) or the PC's cursor keys, and the system makes use of both pop-up menus and icons to help users decide what to do. Up to twenty windows can be defined during a *Decision Manager* session, and any ten of them can be on the screen at the same time. A "state" option provides *Decision Manager* with a long-term memory, permitting users to leave the program and return to it later at exactly the same place, without having to recall data or spreadsheet templates.

For all this, Peachtree's new window system seems a little less powerful than those of its competitors. *Decision Manager* does not automatically update all the user's windows at the same time, which means the user has to move data manually from one screen to another; in this respect, the Peachtree system resembles the 3270-PC window system. The strategy is less powerful for any one application, but it will allow Peachtree to implement windows in its other products—a goal that's being pursued vigorously back in Atlanta.

Pricing for *Decision Manager* is a little new and different, too. The product is scheduled to retail for $825, but buyers during the first ninety days can have it for $625. More interesting is the upgrade policy. Every user will be able to upgrade *Decision Manager* at any time for $150 plus the old copy. The first upgrade is free, and the policy will stay in effect for five years after initial purchase.

"But the biggest difference of all," said Imlay, "is that we'll begin shipping *Decision Manager* on June 15th—and that's no bazanga." (Readers familiar with Imlay's storytelling style will not wonder what bazanga is; others may hazard a guess.)

Decision Manager users will need at least 256K for their PCs. The program will run on a standard PC with floppy disks, but an XT (or a PC equipped with a hard disk) is strongly recommended by Peachtree. DOS 2.0 is required for XT users, but PC users can use DOS 1.1 if their hard disks are compatible. A color/graphics display is required for *Decision Manager*'s windowing system.

Peachtree's other new of-

A Peachtree Grows in Manhattan

ferings also have the "no bazanga" delivery date, are available for a variety of computers, and include more business applications as well as programs for the home and education markets.

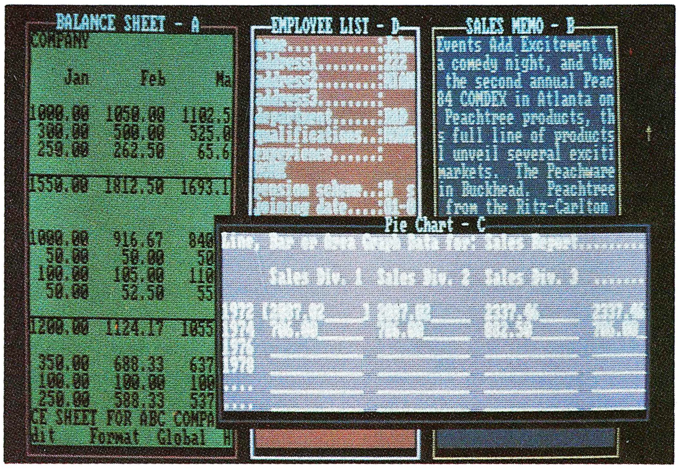
Peachtree's *Back to Basics* accounting system is probably the most exciting of the new business offerings for PCs. The three-program package is an inexpensive, full-function accounting system designed for small business users wanting to move their accounting from the backs of envelopes to both sides of a floppy disk.

Designed to run on PCs, the Forth-based system includes general ledger, accounts payable, and accounts receivable programs that will enable users to maintain and monitor the financial status of their operations. Outputs include full income statements and balance sheets, trial balances, and a variety of cash journals. Users are also provided with an accounting tutorial to help them learn the more formal rules of accounting necessary for a computer-based system.

Back to Basics provides many accounting tools more often associated with corporate-style systems, including automatic calculation of accounts payable discounts and aging of receivables, along with small-business-oriented features, such as cash register reconciliation. The accounts receivable module will produce statements (including a variety of dunning notices), and accounts payable will write the user's checks. All three programs provide extensive financial reports.

Up to ten company departments can be included in an implementation of *Back to Basics*, and users can supply a variety of financial terms for both customers and vendors. Administrative chores, such as mailing-label printing, can also be done with the system.

The *Back to Basics* accounting system will run on a PC*jr*, but the general ledger program requires an expansion chassis because two disk drives are required (the demo model at the news conference was equipped with Tecmar's box). The system is also available for Apple II, Atari 800, and Commodore 64 computers; a Macintosh version will be available at a later date. The PC version comes as a package, with all three programs, priced at $295. Versions for other computers (including PC*jr*) are priced separately at $95 each.



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 100.00    105.00    110
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Two other products rounded out Peachtree's new business offerings. A new fixed-assets accounting program, which offers both book and a wide variety of tax depreciation accounting methods, brings to eight the number of accounting packages in the company's integrated business accounting series. Another new product, *PeachPlan*, gives users a budgeting and forecasting tool with spreadsheet capabilities. *PeachPlan* interfaces with Peachtree's general ledger program, providing PC users with a "budget versus actual" analysis tool.

Peachtree's new *Home Software Library* includes programs for all age groups. The packaged product is available for the PC and the PC*jr*, but PC*jr* is the real target for the library. "We want to put an end to the complaint that there's no home software available for PC*jr*," said Imlay.

Programs for adult family members include *Home Accountant* for money and budget management, *Home Analyst* for spreadsheet-style planning in the home, and *Home Writer* for firing off letters to the editor. *Home Writer* will also be useful for student homework assignments, but other products are more education- and games-oriented. These include *Basic Tutor* (for learning how to program), *Compu-Read* (for improving reading skills), *Compu-Spell* (designed to increase spelling vocabularies), and *Prisoner Adventure Game*, (described as "intellectual entertainment" for all ages).

Peachtree's efforts to produce the *Home Software Library* may help solve the home-oriented software problem for PC*jr*, but the offering is packaged in such a way that it could be difficult to sell. The *Home Software Library* will be available in a $395 package that includes all seven programs. Imlay noted that, sold separately, the library would cost over $800, but it's hard to imagine adult-only families being thrilled at having to buy *Prisoner Adventure* to use *Home Accountant*. Later discussions with an MSA educational software marketing manager revealed that *Compu-Read* and *Compu-Spell* will be available separately, but prices aren't yet firm.

Peachtree announced several new educational programs, but all save one are not available for the PC or PC*jr*. The new Apple II-based products provide educational help for reading, writing, vocabulary, and poetry, along with mathematics and strategy games. Some even include voice synthesis to help students learn such things as poetic meter. Only the new *Writing Skills* program is available for PC users.

The education programs are products of EduWare, which was acquired by MSA only last year, and an MSA spokesperson attributed the lack of PC-based products to EduWare's Apple II orientation. She added that several of EduWare's existing products will be ported to the PC "as soon as possible" and that some will be ready by this fall.

During the news conference, MSA executive vice president Dennis Vohs voiced the company's view that the key to success in the microcomputer software industry is a broad product base combined with strong marketing and management skills. MSA is running fast to build on the product base it has in the IBM mainframe world.

When asked why Peachtree had decided to announce so many new products at once, Vohs replied, "We've never had a hit record in this business, but we don't want to need one."

A possibly more realistic view was offered by another MSA executive: "If you're going to spend this much money, you'd better get a lot out of it." The Helmsley Palace Hotel is many wonderful things, but inexpensive isn't one of them. ▲

Phoenix Software Offers ROM BIOS to OEMs

NEW YORK—Phoenix Software has announced legal stress relief for the makers of PC-compatible computers. At a press conference held May 9 at the new Grand Hyatt Hotel, the Norwood, Massachusetts-based systems engineering company unwrapped *PC-Compatible ROM BIOS*, a product described as a totally PC-compatible operating system. *PC-Compatible ROM BIOS* will be available on an OEM basis to any current or potential manufacturer of PC-compatible computers.

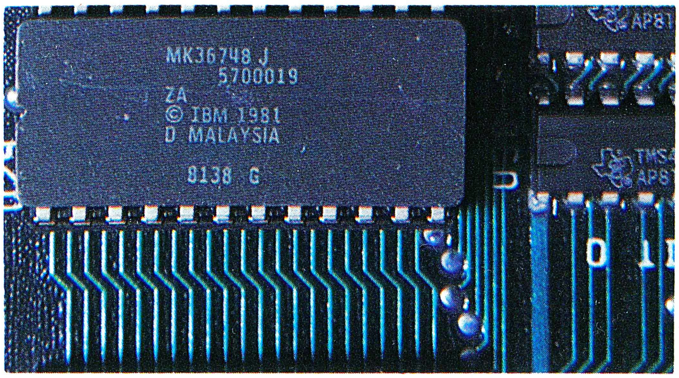
Phoenix claims that its product, which includes both PC and XT support, is functionally identical to the ROM BIOS programs in the PC II (256K motherboard) version of the IBM PC. BIOS routines for PC*jr* and the 3270-PC are not provided.

For a one-time charge of $290,000, the package offers the ROM BIOS routines, a PC-DOS-compatible version of MS-DOS 2.11, a version of Microsoft GWBasic that "resembles" IBM's BasicA, and several PC-DOS-compatible utilities. It is up to customers to install the BIOS programs in ROM and interface them to their own hardware.

Possibly the product's most unusual feature is a liability insurance policy. Phoenix has retained the Hartford Group of Insurance Companies to insure customers against possible copyright infringement suits from IBM. The Hartford Group policy provides up to $2 million to cover defense costs and financial liability should IBM sue a Phoenix BIOS customer for copyright infringement. Customers can participate in the insurance plan for a "four figure" premium.

BIOS stands for Basic Input/Output System. The programs in the BIOS control the basic operation of the PC and its interactions with the outside world; they provide the interface between the PC's Intel 8088 processor and all connected input and output devices, including disk drives, video displays, keyboards, and printers.

"Without this important piece of firmware, a machine can never be truly compatible [with the PC], yet several manufacturers who have created their own compatible ROM BIOS have been sued," said Phoenix president Neil Colvin.



IBM has in fact sued several vendors recently for infringing on the copyright of the PC's ROM BIOS programs. IBM has claimed that the BIOS programs contained in the other vendors' machines so closely resemble those of the PC that they may even have been copied directly. An earlier case, in which Apple Computer charged Franklin Computer with a similar form of copyright infringement, was settled out of court.

(David Grais, of the Wall Street law firm of Grais & Richards, said that Phoenix had approached IBM and offered them the opportunity to examine the programs. "We wanted them to be satisfied the programs were not copies," he said. IBM declined the offer, according to Grais, because they receive many similar requests and couldn't honor all of them. Representatives of IBM's Entry Systems Division in Boca Raton, Florida, declined to comment on the Phoenix announcement.)

How is Phoenix able to guarantee that PC-compatible vendors using its BIOS routines won't be subject to copyright infringement claims from IBM? Obviously, Phoenix can't guarantee that IBM won't sue, but customers may be reassured to know that the Hartford Group, a major force in the insurance industry, is willing to provide liability and legal cost coverage.

We asked Phoenix Software to send us a copy of their Hartford Group policy so we could find out more about this unusual insurance coverage. To get an expert opinion, we asked Thomas R. Meaney, president of a Wall Street insurance brokerage, to study the policy.

Meaney affirmed that the policy insures against financial liability and legal costs in case of a copyright infringement suit, which is exactly what it claims to do. He also noted that all participants in the writing of the policy are "quality" companies in the insurance business and can be relied on. Meaney was not sure of the adequacy of the $2 million maximum until it was explained that IBM had not, so far at least, asked for any financial damage settlements in their PC suits.

Then came the big *but*.

"But they [Hartford] obviously consider this to be a big risk," said Meaney. "It's almost as if they expect a suit right away."

How did he reach this conclusion? "The $37,000 aggregate premium is extremely high for only $2 million in coverage," he said. "Besides, there's a $50,000 deductible on any incident, which makes the effective premium $87,000 if there's a suit." Meaney noted the possibility that lack of insurance experience with this type of policy could have affected the size of the premium, but he still felt the premium was out of line.

To meet its objective of achieving functional PC-compatibility without copying the PC's programs (which are published in IBM's *Technical Reference* manual), Phoenix divided its development team into three groups. A designer wrote the functional specifications, based on the *Technical Reference* manual program listings; a geographically separated team of technicians tested the code for functional compatibility; and a lone programmer, presumably in some remote cabin in the Berkshires, wrote the programs. Phoenix's programmer had no previous experience with IBM PCs or with the 8088/86 family of Intel processors. He was, according to Colvin, a genuine PC "virgin" whose past micro experience mostly involved the ill-fated Texas Instruments 99/4A.

All communication among members of the development team was carried out in writing, and a careful log was kept. "It's a stack of paper about five feet high," said Colvin, "which ought to make any court feel they have enough evidence to legitimize 8K worth of code."

Phoenix Software is better known among systems engineering and programming customers than among PC users. Their work has involved interfacing versions of MS-DOS on various PC-compatible micros, and they have a line of highly technical products that includes a sophisticated linkage editor and symbolic debugger for large-scale PC programs. Customers for their systems programming work have included Microsoft, Compaq, Digital Equipment Corporation, Texas Instruments, Otrona, Sony, Victor, Siemens, Wang, and others in the PC-compatible and 8088/86-based micro business. ▲

MARKETALK REVIEWS

Job Cost for the IBM PC

Job Cost for the IBM PC is a versatile, easily tailored, self-contained job-costing system that simplifies job estimation and bidding and provides many useful reports to track job costs. Contractors and others in job-costing businesses will find this program easy to learn and use.

The package comes in a three-ring binder and slipcase. There are no keyboard overlays or quick reference cards, but you won't miss these amenities once you use the software.

The manual is easy to comprehend, even for computer neophytes. It contains a step-by-step demonstration that shows how to input data and print reports. For a novice, this should take four or five hours to complete. After a user knows how the system works, he or she learns how to create or adapt current job-costing books to the system. Screen illustrations, sample reports, and various appendixes also are included.

With two disk drives, up to one thousand accounts can be defined and divided among four areas: general ledger accounts, vendors, job codes, and work codes. You're limited to four thousand estimate accounts, which are individual job codes with associated work codes.

For example, if you create 100 job codes, you can assign as many as forty work codes to each job. The manual indicates that up to 2,000 accounts and 3,000 estimate accounts can be managed by the XT.

The program is menu-driven, with plenty of prompts. Full use is made of the function keys, and each program disk has its own main menu that allows access to various features of the system. Screen display formats are excellent, and a numbering system lets you know which main menu and submenu you're in if you forget.

Before you can create your own set of books, you need to gather data about your company's jobs, progress reporting systems, and accounting requirements. The program provides various worksheets to help you accumulate and organize this information. General ledger accounts, the company configuration, work-code structuring, job purchase prompting, and vendors are all programmed into the system.

Job transactions are recorded in five journals: cash receipts, job purchases, inventory transfers, labor costs, and a general journal. Entries to the journals can be batched (up to fifty at a time), an option that gives the user a chance to review input before writing it to the journal. The journals and the general ledger can be displayed on-screen or sent to the printer.

At the end of the accounting period, you can post each journal to the appropriate general ledger accounts with a single command. Then, after printing the financial statements for your records, you can close the books with an end-of-period command. At the end of the fiscal year, income and expenses for closed jobs are zeroed by an end-of-year command.

The program offers a choice between reporting job income by the completed-job method or the percentage-of-completion method. You can record actual quantities to journals as well as the dollar amounts.

One of the best features of the *Job Cost* system is its ability to recalculate and update automatically the unit costs based on the actual costs incurred as they are reported. This creates an up-to-date file for future job estimating.

Many good text reports are available with *Job Cost*. Formats are straightforward and can be viewed on-screen or printed. The job estimate report shows all the associated unit rates, quantities, and dollar amounts for all work codes.

A job status report compares actual with estimated costs. For percentage-of-completion jobs, the job status report also shows recalculated projected costs based on the actual cost to date and the reported percentage-of-completion. There's a monthly consolidated profit-and-loss statement for all jobs in the system and a monthly income and expense statement for each job.

One shortcoming of the system is the absence of charts or graphs in the reports. Some businesses may like to display cost variances with graphics. All in all, though, *Job Cost for the IBM PC* is an impressive automated job-costing system that doesn't require that you be a computer whiz.

—Douglas J. Ascoli

Job Cost, BPI Systems (3423 Guadalupe, Austin, TX 78705; 512-454-2801). $795.

Galactic Gladiators

What's the real message of *Star Wars*? Theoretically, it has something to do with man's spirit being stronger than the technological wonders he creates. But most people couldn't care less. They just want to watch Luke and Han zoom around shooting people. There's the real message: Slash! Bang! Smash! Powie!

Strategic Simulations has produced a game in the same spirit. Or rather, they have translated said game from the Apple. The PC version, written in Basic, is slower than the original, and it features blocky graphics and discordant music. But the slash-bang-smash-powie is still there.

Now you too can enjoy an afternoon of killing aliens. And what aliens! There are fourteen varieties. The Cygians are cute, the Froglodytes grotesque, the Zorcons mysterious and sinister. The Oranguphins are just plain weird. The Mutants' touch is always fatal. The Gorsai are greedy mercenaries who can change sides in the middle of a fight.

If you tire of killing aliens, you can pick an alien race and start sniping at the humans. Or fight a different alien race. Or mix species and take all comers.

The weaponry of *Star Wars* is there too: laser swords, phasers, disrupters, stun wands, and lots of other slash-bang-smash-powie. Different races tend to use different weapons. A little Koraci, for example, can't use anything heavier than a vibro knife, whereas a hulking Dulbian can use a heavy disrupter. A single blow with the disrupter would almost certainly kill the Koraci, whereas it would take several slashes with a vibro knife to dismember the Dulbian. On the other hand, the Koraci has more dexterity than the Dulbian and may get in several slashes while the enemy flails at the air.

In addition to the usual weapons, there are some strange ones. A "gemstone," for example, is a homing missile that zeros in on its target and explodes. A "heat ray gun" is a sort of inverse neutron bomb that destroys walls but leaves people standing.

The scenery also recalls *Star Wars*—bars, mazelike corridors, spaceship interiors, alien ruins. You can fight at close range, medium range, or long range. If none of the standard arenas pleases you, you may create your own or have the computer create one randomly.

In addition, the game has its role-playing aspect. Every time a character hits somebody, he has a chance of increasing his skill. Assuming he survives, he gets better and better with his chosen weapons. Since characters can be saved to disk, you can play your favorite team over and over. (The game can also be saved.)

Perhaps the best feature is the player's freedom to manipulate the elements. You can create any team you like and fight anywhere you like against anyone you like. For many gamers, exhausting all those possibilities will be a long, pleasant process.

—Forrest Johnson

Galactic Gladiators, Tom Reamy (IBM version by Paul Reisberg), Strategic Simulations (883 Stierlin Road, Mountain View, CA 94043; 415-964-1353). Requires color/graphics adapter. $39.95.

Multi-Job

Multi-Job is a multitasking program that permits the PC to run up to nine programs at once. It divides the computer's memory to hold the separate programs, with one program switched to the foreground for keyboard input and display while the others function as background tasks. The keyboard and display are attached only to the program running in the foreground. The alt key and a digit from the numeric keypad bring a task from another partition to the foreground.

Ordinarily, your computer is waiting for you or you are waiting for your computer. Programs such as word processors and spreadsheets spend most of their time waiting for keyboard input or for the printer to catch up. Other programs, such as updates of inventory records or lengthy sorts, are computer-intensive. Once begun, they require little input and leave users waiting for the program to finish.

Multi-Job serves as the traffic cop, telling the programs to stop and go. It lets the PC work on computer-intensive chores during those microseconds while you are at the keyboard or a character is on its way to the printer.

Multi-Job's partitions can also serve as a parking place for programs not currently running. A communication package can rest in one partition ready to go on-line, or DOS can be standing by to format a disk or read a directory.

When a program is operating back in the bushes, *Multi-Job* maintains an area of memory to receive screen input in place of the video display. Background tasks can be set to discard video display or to suspend work until they are brought to the foreground, where the screen will be restored. If a program requires keyboard input, its operation is suspended until it is brought into the foreground.

Several programs that need the 8088 can share the processor while they are background tasks. All segments can share equally, or priority can be given to the foreground task.

Multi-Job defaults to two partitions, with 64K in task 2 and the rest of the memory dedicated to task 1. The number of partitions can be specified and their sizes set when *Multi-Job* is invoked, or it can be done with an Autoexec.bat file.

Electronic disks that are set before *Multi-Job* is called are "global" devices, and all segments can use them. Electronic disks set from within a partition are "local" devices and can't be accessed by other partitions.

Generally, two or three programs are all that should be attempted at any one time or the computer becomes slothful. The recommended minimum is 48K for each partition; since the program requires space to run, 19K is needed for DOS, and 4.5K is consumed as *Multi-Job* overhead. The first partition requires an additional 3.5K to hold the *Multi-Job* management system.

For all the beauty of the *Multi-Job* idea, the program has a few warts. *Multi-Job* is on a copy-protected disk and uses a customizing program to produce a copyable version of *Multi-Job*. The difficulty here is that only one master copy can be made: You must choose between DOS 1.1 and 2.0. Furthermore, in an effort to avoid piracy, Starware has designed *Multi-Job*'s master disk to operate only on the IBM PC for which it was configured. It apparently looks at the equipment switches and makes them part of its initialization check. If you add memory or peripherals, *Multi-Job* won't work anymore.

Multi-Job's key commands are simple enough, but it's up to you to keep track of where you are and what you're doing in each partition. Users are on their own in making sure that the proper disk is in the drive required in any particular segment, for *Multi-Job* makes no check and gives no prompt for the disk. One could find oneself in serious trouble with open files written to by the wrong program, and things are bound to become messy if two programs are sending data to the printer.

Multi-Job doesn't have the ability to move data from a program in one partition to a program in another, and individual partitions can't be rebooted under *Multi-Job*. A reset is an all-or-nothing affair, and unless a program has an exit command, it will have to wait until all the tasks are completed.

Multi-Job modifies certain interrupt routines, and this makes it incompatible with software that also depends on modifications. *1-2-3* modifies DOS and writes directly to the screen, so it won't work with *Multi-Job*. Other programs, such as *SuperCalc2*, have to finish writing their data to the screen before being moved to another partition or the updated display won't be there on return. It's best to make a trial run with any given combination of programs under *Multi-Job* before beginning serious work.

The concept of multitasking promises full use of the PC's capabilities, but *Multi-Job* could use a little more error-checking to keep operators out of trouble. At present, two or three pieces of selected software can work well together in *Multi-Job* at any given time. With a few more safety features, this frog could become a real prince.

—Dian Crayne

Multi-Job, Starware (2000 K Street N.W., Washington DC 20006; 202-331-9933). $159.

c-window

Debugging aids are almost mandatory for large programming projects in any language. Using a machine-code level tool, such as IBM's Debug, requires specialized knowledge and isn't really adequate for trouble-shooting programs compiled from high-level languages. *c-window* is a tool for testing and debugging C programs at the source level; it's designed for use in conjunction with the C compiler from c-systems. *c-window* allows you to debug your programs at the symbolic level by using C program variable names, expressions, structures, and constructs. There is no need to look at or deal with machine registers or actual memory addresses.

To include the debug facility in a program, you select the −w option at compile time. This causes the compiler to construct a table of function and variable names and to save other data needed by the debugger. At link time, the debugger library code is added, resulting in an executable user program containing the debugger executive.

Although the debugger code resides in its own code segment, its tables do consume some of the user program's data space. A program that ordinarily fits into a given amount of memory, therefore, may not fit when linked to the debug facility; functions with many variables may need a table so large that there is insufficient space left over for the debugger.

When you run a program the debugger installed, your screen is divided into three horizontal windows (provided you're using an IBM-compatible screen).

The top window is reserved for interaction with you, the programmer; this is where you enter debug commands and see responses from the system.

The middle window is for input and output interactions with the program being debugged; this window occupies only five lines of the screen, so the debugger automatically maps all program input and output to scroll through this area. If your program uses direct cursor-positioning commands, these will *not* be remapped into the middle window. Unfortunately, they may cause text in the upper or lower windows to be overwritten. Such text would also scroll, along with each window.

The lower window contains a display of the source language statements (if the source file is available) currently being executed. As statements are executed, this window scrolls to show the current and next few statements. The current line is prefixed with the source-code-file line number. This handy facility can reduce your need for printed listings when you've made minor source-code changes.

Consider the following main function:

```
main (argc,argv)
int argc;
char *argc[];
{
```

When this program is run, the debugger will wait at the program's entry point (the first executable statement). The *d* command displays variables in several different formats; *d argc* displays the value of argc in hexadecimal. If the program were run as PROG.P1, the value of argc would be 2 and argv[1] would point to the string P1. *ds argv[1]* displays the string pointed to by argv[1]. Variables can be displayed in decimal or hexadecimal, as characters or strings, and in byte and word hex formats. Unfortunately, the default is hex. Most users would probably prefer decimal.

The *s* command allows you to step through the program one C statement at a time. At any step, you may display or modify any variable. At each step, the current function name and line number are displayed. The *t* command allows you to trace through a series of single steps.

Several types of breakpoints are possible (a breakpoint indicates some position within the program at which the user wants to inspect certain variables). *g func,46* causes the program to run until it gets to line 46 within function *func*; line 46 will not be executed. This type of breakpoint is cleared once it has been performed. More permanent breakpoints can be set at any function/line combination. Breakpoints can be set to break each time they are encountered, after they have been encountered a specific number of times, or when a user-defined condition has been met; this last option is extremely handy. Breakpoints can be listed and can be cleared individually or collectively. Another nice feature is the fact that you can type any key to return to command mode; that's great for stopping runaway programs.

Up to five debug command macros can be defined. These macros, which can be set to execute during step, trace, and breakpoint operations, spare you the trouble of reentering lengthy display commands that you use regularly. Macros can be displayed and cleared individually or as a group.

All local variables can be displayed by way of the *l* command; their stack and data segment offsets are also shown. This feature is useful for monitoring the use of stack and data space. External variables also can be displayed. The *p* command identifies the function and line number where the debugger is currently positioned, and the *c* command reveals the source code statement at a given line number.

c-window has a few annoying drawbacks. Although both uppercase and lowercase commands are accepted and correctly interpreted, the command syntax is not quite free-format. The command set is not orthogonal and could be improved upon. The *help* command scrolls the help text through the top window, and the top part scrolls off; the text could be rearranged so that this wouldn't happen. The *g* command typically causes the program to run to completion, at which time it exits to the operating system; it would be better if it returned to the debugger instead, as Debug.com does. Currently, you're required a breakpoint to prevent exit to the system.

These are minor irritations, however. The only significant deficiency is *c-window*'s inability to generate hard copy of trace data; you have to use print-screen, and that's not workable for dumping programs of significant complexity.

c-window is simple to use and powerful. It's priced a little high, perhaps, in comparison to the c-systems compiler, but, considering the labor- and time-intensive alternative, you may find it paying for itself in a short time.

Telephone support is included.

—Rex Jaeschke

c-window, c-systems (Box 3253, Fullerton, CA 92634; 714-637-5362). $195. Requires compiler, which also costs $195.

Financial Planning for Multiplan and the IBM PC

In *Financial Planning for Multiplan and the IBM PC*, Expert Systems has created eighteen *Multiplan* template files to handle elementary and frequently used financial formulas. Categorized into six main functions, the files structure the user's analysis of basic financial analysis. The templates, referred to as "calculators," perform compound growth calculations, annuities, discounted cash flows, profit planning, depreciation schedules, real estate finance, and linear regression and basic statistical measurements of a population. Because the files are designed as templates, the flexibility of the spreadsheets is limited, although they can be expanded by the user.

Several of the spreadsheet files use some of *Multiplan*'s better features, and all the template cells have been locked to prevent overwriting or erasing. Some of the worksheets take advantage of *Multiplan*'s split-screen feature. For example, the linear regression calculator uses a

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second window for input and the first window for the display of the worksheet results. The manual states that the user must turn off the recalculation key to enhance the responsiveness of the worksheets.

Several of the calculators provide enough room to evaluate four different problems or variations of one problem. For example, the user could evaluate a mortgage loan payment at different mortgage loan levels.

Only one worksheet duplicates a function already available in *Multiplan's* function library, the NPV function. The template structures the user's analysis and relieves him or her of entering the proper formulas.

The IRR function (for internal rate of return), assumes, as most models do, that the stream of cash flows will be simple. If the cash flows encountered have more than one sign change, multiple IRRs can result.

The break-even calculator produces accurate but clearly ridiculous results if the profit margin percentage input exceeds the contribution margin percentage. Although it is difficult to imagine such a situation, it is conceivable that a user might misinterpret the template and get a wrong result rather than an error message.

The compound-growth calculators handle two types of problems: the customary compound-growth situation and the continuous compound-growth calculation. Present values, if entered as positive amounts, cause future values to be displayed as negative amounts and vice versa.

The annuity calculators tackle four common financial problems: ordinary annuity, annuity due, continuous annuity, and amortization schedule calculations. The amortization schedule calculator handles balloon note calculations and permits the user to specify a project name.

The discounted cash flow analysis calculators do three common analyses: a project's net present value, internal rate of return, and/or financial management rate of return. The worksheets are designed to fit up to sixty cash flow estimates. These are the only worksheets that provide on-screen instruction in the use of the template.

The profit-planning tools provide worksheets to standardize a break-even analysis, compute depreciation using various depreciation methods (straight-line, double-declining balance, sum-of-the-years), and compute depreciation using the accelerated cost recovery system. The basic statistics and forecasting calculators compute the mean, standard deviation, and variance of a population and do the calculations that return the slope, y-intercept, correlation coefficient, minimum and maximum value, arithmetic mean, standard deviation, and estimated value for the dependent variable, given a value of the independent variable. The worksheet's limit is sixty observations or sets of data points.

The real estate finance calculators provide some answers to questions about variable rate mortgage, graduated payment mortgage, graduated payment adjustable mortgage, and wraparound mortgage problems. These worksheets allow for up to six different interest rates in computing the resulting mortgage payments.

The manual devotes a complete chapter to operating procedures and a discourse on how to create your own calculators before it describes each of the six financial and statistical calculators provided in the program. The part about operating procedures steps you through the keystrokes to load a calculator into the system and should present no problem to the beginner. The section on creating your own calculators, however, is a four-page treatise on elementary programming. Rather than show the user how to create or modify the existing calculators, it discusses problem definition, screen design, and algorithm selection and production—hardly a hands-on practical approach.

The remaining chapters guide the user through each calculator, with the help of one or two examples. Each chapter includes a bibliography of textbooks covering the subject matter. A glossary of terms at the end of the manual serves as a quick memory jogger of financial and statistical terms forgotten after the final college exam. Finally, an index provides quick reference to the manual section discussing the selected topic.

Unfortunately, the quick reference guide provided duplicates the third through eighth chapters. The text and examples are identical, so if you have trouble understanding the material in the manual, the guide will be no help.

Overall, this product is not bad. If you often use a hand-held calculator to do financial calculations such as compound interest, net present value, break-even points, depreciation, and the like, this series of *Multiplan* files will save you time.

—Mark C. Herbers

Financial Planning for Multiplan and the IBM PC. Expert Systems (4300 West Sixty-Second Street, Indianapolis, IN 46268; 800-428-3696). Requires *Multiplan.*

Leading Effectively

Computer-based training has grown up and moved into the executive suite; *Leading Effectively* is a highly flexible training package designed to be used by individuals or teams. It can be used as a self-study unit by managers wanting to improve their management style, or it can be administered by corporate training departments in developing management teams. The materials are based on management techniques that have been developed over the past forty years. The training is personalized, private, interactive, and self-paced.

The program consists of two floppy disks and a well-written 140-page workbook that provides operating instructions, program descriptions, and learning objectives for each study unit. Worksheets are included to help the user evaluate leadership style and develop action plans for implementing the newly learned skills on the job. The workbook also provides guidelines for further development of leadership skills and a bibliography of current books on management techniques.

The first disk contains all four of the study units, a glossary of management terms, and an additional copy of the bibliography for easy reference. Access to the material is through a graphic menu called a Thoughtree, which resembles a corporate organization chart. To start the system, the user selects the number of the box containing the desired lesson. At the end of each lesson, the Thoughtree returns so that another lesson can be selected. Each lesson leads the student through a

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series of logical steps into a better understanding of the tools of leadership. Built-in questionnaires assess the student's leadership skills and compare them with national norms.

Managers can compare their self-assessment with their subordinates' views of their leadership style. Each manager enters his or her name and the number of subordinate people. Then each subordinate uses the computer in private and answers a series of questions. The manager can then obtain comparisons between his or her own views, those of his subordinates, and the national norm for people in leadership positions.

The quality of the package is good. The system is easy to start and use. The Thoughtree menu and on-screen prompts guide the user at every step. The graphics are simple and colorful, with enough variety to hold attention. One problem, however, is the use of color to highlight words of text. Unless your monitor is in top condition and carefully tuned, the highlighting makes the words harder to read. A few sound effects reward the user for correct answers and emphasize key points, but if the program is used in an office nothing would be lost by turning the sound off.

A color monitor is almost a necessity. Although the program runs on a monochrome display, many of its text screens and graphics will be difficult to read. Running the program in color not only improves its readability but also improves the learning process. The careful use of color text and graphics adds variety and provides a psychological emphasis of the message.

Two software problems were found. The first was in the subprogram that graphs the user's self-assessment. The entire character of the graphics changed at this point and became faint, distorted, and hard to read. Fortunately, the information was presented again in tabular form after the program returned to its normal mode.

The second problem was simply a matter of one portion of the program not being as convenient to use as the rest. Once the user starts the second program disk, there is no way to return to the menu without going all the way through the questionnaire. The same is true when a manager comes back to retrieve the data his subordinates entered. To get to the data, he or she must work through the instructions before reaching the menu.

The results of *Leading Effectively* should be excellent. The training materials are arranged logically and are easy to follow. Learning goals are established, and a variety of methods are used to achieve them. Best of all, the training is personal. It's like having your own management consultant to coach you on the job.

Thoughtware maintains a toll-free number for users to call if they have problems, and their response is prompt and courteous. This training package is one of ten in Thoughtware's Management Series.

—*Thomas L. Bever*

Leading Effectively. Thoughtware (2699 South Bayshore Drive, Coconut Grove, FL 33133; 800-848-9273). Requires 128K to run under DOS 2.0. $450.

Colorgraphy

Given its $99.95 price tag, *Colorgraphy* should be a hands-down winner for any user needing a color/graphics editor. Sadly, it isn't.

The program consists of a graphics editor and a slide-presentation program. A plotter-printing program (*Plotography*) is available at extra cost.

The color graphics editor is a menuless screen with cursor. You enter commands either by pressing single keys (such as *A* for arc) or by using the function keys to set certain environment features. Cursor moves are implemented, in one of two adjustable increments, from the keyboard.

Colorgraphy distinguishes between pictures and drawings. The former are limited to 60-by-60 pixels and can be extracted separately from current drawings and saved for later reuse (but not merging) with an existing drawing. A picture is a whole screen.

Commands available include *arc, box, circle, duplicate, ellipse, flip, go to, set cursor increment, clear rectangle, line, move, paint, rotate, scale, text insertion,* and *vanishing point*. Of the nonobvious commands, *duplicate* is limited to copying rectangular images that cannot exceed sixty pixels on a side. *Flip* produces a mirror image of any designated rectangle, again limited to a 60-by-60 area. *Go to,* a potentially useful command, requires that the user know which of 320-by-199 positions he or she wishes to move to. *Rotate* and *scale,* like their companion commands, also are limited to a 60-by-60-pixel area.

Environment commands, nicely summarized on a pop-up screen, include a function to define a screen brush of up to one hundred bristles or different color lines. The bristle mode, once defined, can be turned on at will to allow broad brush and colorful painting. A coordinates display can be turned on, as can a prompt mode for some of the commands. Another key saves the picture or drawing to disk, and still another retrieves it. The final keys print the drawing and end the session.

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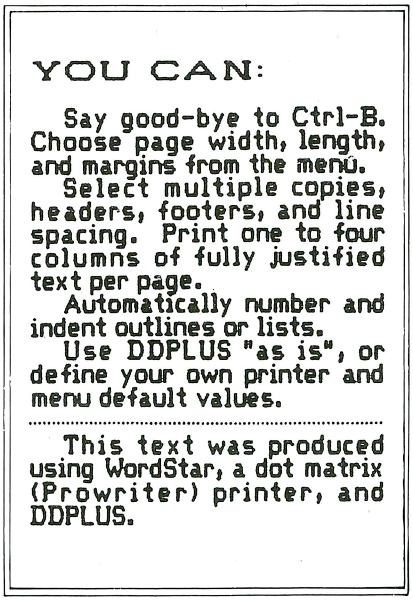

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This text was produced using WordStar, a dot matrix (Prowriter) printer, and DDPLUS.

The slide-show program allows the user to view created drawings by specifying which ones are to be shown and the duration of each. Presentations can be stored for repeat viewing. The resolution of the screen (high or medium) is adjustable as well.

The requirement that the user think in screen points and locations is a shortcoming of this program. So is the arbitrary 60-by-60 limitation on most of *Colorgraphy*'s advanced functions. Even so, however, the program would be worth its price if it weren't unacceptably slow.

Initially, it was hard for this reviewer to understand how the system could be so slow in its handling of cursor moves (the cursor "runs on" to keep up with repetitive move commands, disappears, and generally acts up every chance it can) and screen manipulation. A call to the manufacturer brought word that the slowness is a consequence of the implementation of one remaining *Colorgraphy* command, the backspace key. This key serves as a partial "undo" key for the system. That is, you can hit it immediately after any command and restore the system to its state before the command. To implement this function, unfortunately, the screen must be saved after each command.

The manual for *Colorgraphy* is adequate at best, being a straightforward description of the system's commands without examples (excepting one appendix example) or tutorials. A disk of sample screen files is included, however, for viewing and as a demonstration of the system's abilities. Only BASIC's error messages are implemented (the program is in compiled BASIC), and the *Colorgraphy* manual warns that the system cannot trap certain combination keypresses, such as control-break.

Despite its low price and some unusual functions (the bristles command, for example), this software may not be the best choice one could make in a graphics program.

—Thomas V. Bonoma

Colorgraphy. Cactus Software (Box 880, Peoria, AZ 85345). $99.95. Requires 128K, color/graphics adapter, and an IBM (or fully IBM-compatible) printer.

MetaWindow

If you're not a programmer, you might as well skip this review, because *MetaWindow* is definitely not a user's package.

It is a sophisticated set of graphics procedures, written in assembly language, that can be interfaced with Pascal, C, or the *Macro Assembler* to create graphics programs. These procedures do line drawing, color fill (with either single tone or dither), image mapping, and mouse handling, as well as providing the ability to create custom text fonts and variable-sized windows. Some of the procedures are written at a basic level, allowing you to poll the current mouse status or determine the current cursor coordinates. Other procedures are extremely powerful and do such things as moving bit-mapped images from the screen to an array and back. Still others control line clipping, which is available within defined window limits as well as the full display screen.

There are five *MetaWindow* routines that interact with an "event queue," which buffers user input. This input can be a keystroke, mouse button, and so on, but there's no information in the manual regarding the size of the queue. A note under function Storevent suggests that an "EVENTQUEUE(false)" call should be issued to avoid intermixing queue events with "programmed events," but it does not elaborate. There's no discussion of queue initialization or how the queue size can be changed.

We tested *MetaWindow* on a 128K PC with the standard IBM color/graphics adapter, as well as the Microsoft Mouse, which uses a plug-in board. The package is also compatible with the Tecmar Graphics-Master card, Hercules monochrome graphics adapter, and CCS's Supervision card. It can interface with the PC-Mouse by Mouse Systems and VisiCorp's VisiOn M1 mouse, as well as the Microsoft unit, and it requires a minimum of 128K.

MetaWindow will support the 320-by-200 pixel medium-resolution graphics available with the standard IBM display, or up to 720 by 352 pixels (mono) if you are using the Tecmar board. Unfortunately it does not support any of the hi-res sixteen-color capabilities available with some non-IBM cards.

Two source code samples are included in the package, one in Pascal and one in C. Although *MetaWindow* claims compatibility with the Microsoft Mouse, the enclosed Pascal sample, Draw.Pas, assumes you'll be using a three-button mouse and uses the middle button to display the menu; if you have the Microsoft two-button mouse you must change the initialization of the variable SWmiddle from 2 to 5. This lets you see the menu by pressing both mouse buttons at the same time.

Working with *MetaWindow* can be frustrating for assembly language programmers. The routines tested were obviously designed to work with Pascal, and assembly language interfaces appeared to be an afterthought. For example, Appendix C in the manual shows how to call the procedures from assembler but neglects to note that they must be compiled under Pascal before they can be used. Since the Pascal compiler requires 128K to compile even a trivial program, this meant testing had to switch to a larger machine. In addition, the interface instructions reference the procedures by name but neglect to say what files they are in, or how to introduce them to the linker. The upshot is that unless you're a seasoned assembly language programmer you're apt to be hopelessly at sea trying to figure out what's going on.

Working with the Pascal interface is significantly easier, and the routines are fast, efficient, and comprehensive. Most of the procedures you'll need in graphics programming are included in *MetaWindow*, from Insetrect (which automatically shrinks and expands a given rectangle) to Fillstyle (which lets you select any one of thirty-two color patterns for filling in a given area). Interestingly enough, *MetaWindow* does not have any routines that manipulate circles, ellipses, parabolas, or cones. Presumably the authors feel these functions are simple enough to be left as an exercise for their readers.

The 130-page manual is detailed and contains specific information about each of the fifty-three procedures and nine functions, complete with a sample line showing how each can be invoked through C or Pascal. Return codes, bit maps, and other information is included where appropriate, and there is a chapter on programming techniques for graphics. There is no tutorial, but two sample programs in the manual show how to do interrupts.

The software license agreement included with the manual provides for use only on a single machine, which would effectively limit this product to hobbyist use. However, Metagraphics president Jack R. Davis assures us that distribution licensing agreements are available for developers. What this boils down to is that if you want to use *Metawindow* procedures in a program you plan to sell, you have to negotiate a separate agreement with Metagraphics. This extra cost might well be worth it to programmers or software houses that can't spare the time to develop their own basic routines. However, it is important to remember that the only color graphics currently supported by this package is the medium-resolution, four-color mode available with the standard color/graphics card.

If you work in a language it supports, and you want to program displays for menu icons, games, or other graphics applications, *MetaWindow* can save time and trouble—provided you're an experienced programmer and are willing to gamble on selling enough copies of your program to make it worthwhile. OEM licenses for both source and object code are available, and source code royalties are substantially higher per copy sold. There's no up-front fee for entering into an OEM agreement with Metagraphics.

—Dian Crayne

MetaWindow. Metagraphics (444 Castro Street, Mountain View, CA 94041; 415-964-1334). $150.

▲

MARKETALK NEWS

Δ The *Chase DL* is a diskless network microcomputer from **Chase Technologies** (375 Sylvan Avenue, Englewood Cliffs, NJ 07632; 201-894-5544). The microcomputer incorporates network hardware manufactured by Orchid Technology, the makers of *PCnet*. It is compatible with all microcomputers and software that run in a DOS 2.0 or 2.1 *PCnet* local-area network. $2,395.

Δ **Select Information Systems** (919 Sir Francis Drake Boulevard, Kentfield, CA 94904; 415-459-4003) has introduced *Select Bilingual*, a Spanish/English word processor. It can display international characters without embedded commands. A spelling checker will search for errors in either or both languages. $395.

Δ **ISM** (932 Hungerford Drive, Rockville, MD 20850; 301-279-5775) has entered the portable PC-compatible market with the *Unisystem-PC*. The system features 256K, two 360K floppy disk drives, a nine-inch monitor, two RS-232 ports, one parallel port, 8K of EPROM, and a high-resolution amber display. $2,795. Δ The *Unisystem-XT* has an internal ten-megabyte Winchester disk and one 360K floppy drive plus all the features of the Unisystem PC. $3,995.

Δ **Applied Microsystems** (Box 832, Roswell, GA 30007; 404-475-0832) offers a project-tracking program that tracks tasks over time by either responsibility or priority. *Protracs* allows the user to track up to one hundred separate projects containing one hundred tasks each. A version for the PC*jr* can track up to seventy-five tasks or action items per project. Requires 128K. $59.95.

Δ *Mail Order Pro*, a system for mail-order companies, has been announced by **Professional Publications** (Box 199, San Carlos, CA 94070; 415-593-5119). The system processes mail and phone orders while keeping track of inventory and back orders. It produces mailing labels, credit card sales drafts, packing lists, and COD tags. Reports are produced to identify productive advertisements and active products. $695.

Δ *PC Accounting Trends* is a newsletter for CPA practitioners using IBM and IBM-compatible microcomputers. It provides information on the microcomputing aspects of a CPA firm's audit, tax, write-up, and consulting practices. Contact **PC Accounting Trends** (Box 435, 1850 Union Street, San Francisco, CA 94123; 415-788-2244). Twelve issues, $59.

Δ **Scarborough Systems** (25 North Broadway, Tarrytown, NY 10591; 914-332-4545) has introduced *Run for the Money*, an arcade business game. The key to winning the two-player space game is down-to-earth business sense. $49.95.

Δ **Softquest** (Box 3456, McLean, VA 22102; 703-281-1621) has released version 2 of *The Smart Checkbook*, a personal financial management program. Financial records produced include family budget reports, net worth statements, tax records, custom reports, and summary tables. Money market, checking, savings, credit card, and cash accounts can be tracked individually or in any user-desired combination. Income and expenses can be organized with up to two hundred budget and two hundred tax categories. $149.

Δ A communications package that emulates asynchronous terminals and automatically learns network log on/log off protocols has been introduced by **Direct.aid** (Box 4420, Boulder, CO 80306; 303-442-8080). *The Impersonator* can range from a typewriter mode to a built-in programming language for automating sequences of multiple data transmissions. Requires 192K and modem. $195.

Δ **Mouse Systems Corporation** (2336-H Walsh Avenue, Santa Clara, CA 95051; 408-988-0211) has developed *Designer Pop-up* menu software that allows users to design or person-

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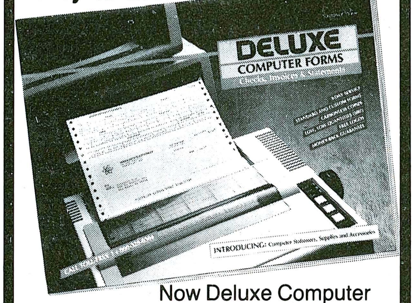

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alize pop-up menus for most IBM-compatible software. Preconfigured pop-up menus are included for *1-2-3, VisiCalc, Multiplan, Personal Editor, Volkswriter, WordStar, SuperCalc 3,* and *MultiMate.* $95.

Δ **Peachtree Software** (3445 Peachtree Road N.E., Atlanta, GA 30326; 800-247-3224) has released *Peachpak 4,* an updated sixteen-bit version of its accounting package for small businesses. The integrated package contains general ledger, accounts payable, and accounts receivable. $395.

Δ *dbMenu!* is a front-end menu driver program from **JNZ** (729 Windward Drive, Rodeo, CA 94572; 415-799-1446) for *dBase II.* With the program, the user can access most *dBase II* commands. It also provides features such as multiple-key sorting. $34.95.

Δ **National Microware** (2960 South Daimler Avenue, Santa Ana, CA 92705; 714-979-7000) has released a software and address book package, *Personal Planner,* that lets users compile and print names, addresses, and telephone numbers. The package comes with an address book that uses tractor-fed forms. $99.

Δ *Astro-Aid* is a software package for astronomical work from **Zephyr Services** (306 South Homewood Avenue, Pittsburgh, PA 15208; 412-247-5915). It includes forty-four astronomical functions for use by professionals or amateurs. An accompanying manual explains the program and the astronomical theory involved. $29.95.

Δ **ACS Consultants** (199 California Drive, Millbrae, CA 94030; 415-697-3861) has released *Prospects Unlimited,* a prospect-management system for salespeople. It provides access to information about sales leads, including a history of the prospect's past purchases and contacts with the salesperson. Requires 128K. $349.

Δ **EduSystems** (2221 University Avenue, Minneapolis, MN 55414; 612-623-4061) has released a PC version of *Church Management Systems.* The program provides contribution/pledge record-keeping, membership information reporting, and a fund accounting and budgeting capability for congregations ranging from one hundred to sixteen thousand members. $2,085.

Δ Two packages have been introduced by **Courseware** (10075 Carroll Canyon Road, San Diego, CA 92131; 619-578-1700). People can polish their selling skills with *Sold!,* a self-teaching package. Included is a second disk with a database management program that keeps track of prospect data, reminders, and appointments. Requires 128K. $79.50. Δ *Basic Jr* is a tutorial package that teaches the fundamentals of Basic programming. Students learn fundamental programming concepts. Included with the package is Graphics Jr, an interactive graphics utility that allows users to draw and paint lines and shapes. $49.95.

Δ **RDT Software** (Box 96634, Weatherford, OK 73096; 405-772-1821) has introduced *Bugscreen,* a symbolic debugger for the *Macro Assembler.* Its display features windows for the source listing, the registers and flags, the stack, and selected memory. During execution, changes are highlighted on the screen. $95.

Δ *Printer Optimizer,* an electronic spooler, is offered by **Applied Creative Technology** (2156 West Northwest Highway, Dallas, TX 75220; 214-556-2916). The device provides separation of computing and printing functions and, if there is more than one printer, lets the operator select which printer prints each job. Storage capacity is expandable from 64K to 256K. $499.

Δ **Continental Software** (11223 South Hindry Avenue, Los Angeles, CA 90045; 213-417-8031) has introduced three home and small-business applications for the PC*jr. The Home Accountant jr* tracks up to five checkbooks, all cash and credit card transactions, and up to one hundred budget categories. The program also prints checks and a variety of reports. $74.95. Δ *The Tax Advantage jr* supports Forms 1040 and 4562 and Schedules A, B, C, D, E, G, SE, and W. It also offers the ability to itemize any line, call up longer descriptions of the lines on the 1040 form, and automatically calculate taxes at any time. $69.95. Δ *The Home Cataloguer jr* is a cataloguing and personal inventory program that can do column totaling on numeric fields. $49.95.

Δ *Dezign* is a graphically oriented structured design and programming tool from **Zeducomp** (Box 68, Stirling, NJ 07980; 201-755-2262). It enables users to create and edit structured flow charts on-screen, store them in a database, and obtain hard copy listings. In addition, users can assign detailed source code statements and conditions to the diagrams and generate *dBase II* command files or Ada, C, Pascal, or PL/1 source code from the comments and control logic represented on the diagrams and the corresponding detailed statements and conditions. The generated source code can then be interpreted or compiled. Requires 128K. $200.

Δ *PC Mail Order System,* from **Data Consulting Group** (12 Skylark Drive, Larkspur, CA 94939; 415-927-0990), logs sales by item, customer, date, serial number, quantity, tax rate, discount, and price; prints or displays sales reports; provides mailing list functions; maintains inventory control; and creates invoices and feeds data to the sales, inventory, and mailing subsystems. $295.

Δ **Excalibur Sources** (Box 467220, Atlanta, GA 30346; 404-395-0306) has introduced *Exsell,* an integrated hardware/software system for sales, marketing, and telemarketing. The system combines information management software with an autodialer telephone to create an automated telemarketing workstation. $750. Software only, $495.

Δ The first in a series of courses on investment and financial analysis is available from **The Wizards** (Box 7118, The Woodlands, TX 77387). *How To Make Good Investments* covers the same material covered in business schools, with some practical street techniques. $150.

Δ **Unik Associates** (12545 West Burleigh, Brookfield, WI 53005; 414-782-5030) has introduced two software packages. *Maintenance Management Software* allows users to maintain records and generate reports on equipment history and preventive maintenance, work orders, and inventory control. Requires 128K. $1,295. Δ *General Engineering Software* is a package of more than fifty programs for engineers, technicians, analysts, and others. It covers areas of general engineering, heat exchangers, hydraulics, and fluid power. $195.

Δ **Pencept** (39 Green Street, Waltham, MA 02154; 617-893-6390) is marketing *Pendpad*, a peripheral that analyzes penstrokes as handprinted characters are formed and generates high-resolution graphics. It uses a technique called dynamic character recognition, which enables handwritten characters to be used in lieu of or in addition to keyboard input. $995.

Δ **Challenge Software** (134 West Thirty-Second Street, New York, NY 10001) offers *Sexware*, a sex-education program that asks more than 200 multiple-choice questions on a wide range of sexual topics and scores the user's sex IQ. $29.95.

Δ **IBM** (900 King Street, Rye Brook, NY 10573; 914-934-4488) has announced *Personal Computer Interactive Executive (PC/IX)*, an operating system derived from the Unix multiuser system. The system can be used for program development, test processing, or running existing Unix system application programs. $900.

Δ *Horsebusiness*, from **Universal Microsystems** (Box 1343, Duluth, GA 30136; 404-449-0690) aids those involved in raising, breeding, racing, boarding, or training horses. It includes full double-entry accounting, customer billing, complete financial reports, and horse information management. $995.

Δ **Individual Software** (1163-I Chess Drive, Foster City, CA 94404; 415-341-6116) has announced that three of its tutorial packages are available for the PC*jr*. *Typing Instructor* provides the integration of instructional lessons with varied choices of instructional methods. $49.95. Δ *Professor DOS* is a comprehensive DOS tutorial for the PC*jr* that teaches users how to copy files, edit programs, and manage floppy disks. $59.95. Δ *Professor Pixel* is an interactive training program that enables users to create graphics, sounds, color, and animation using BASIC. $59.95.

Δ **The Business Division** (Scott Adams, Incorporated, 155 Sabal Palm Drive, Longwood, FL 32750; 305-862-6917) has released *Maxi Accountant*, a business-accounting package for the XT. The package incorporates thirteen integrated modules. $795.

Δ **Softsmith Corporation** (1431 Doolittle Drive, San Leandro, CA 94577; 415-430-2411) is offering two products for the PC. *Micro Cookbook* can select recipes containing specified ingredients, such as items on hand and leftovers. Ingredient quantities can be adjusted automatically to the number desired. $40. Δ *Multi-RAM* makes possible multiple use of a variety of software programs by allowing integration of up to nine programs interchangeably at one time. Onboard help is available, and status messages are displayed on-screen to prevent confusion. $99.

Δ A standalone computer that plugs into a PC, *The Intelligent Data Collector*, from **Tech-S** (12997 Merriman Road, Livonia, MI 48150; 313-425-9800), collects, stores, and then transmits on request such data as time, attendance, and other management information. It is designed to help eliminate errors caused by the handling of time-card data and to reduce the time consumed in calculation and preparation of employee payrolls. $2,995.

Δ **KeyTronic Corporation** (Box 14687, Spokane, WA 99214; 509-928-8000) has introduced a plug-compatible keyboard for the PC*jr*. The keyboard features a low-profile design, familiar typewriter key location, LED indicators on lock keys, and solid-state capacitative switches. $209. With separate cursor-control pad, $255.

Δ **Alpha Software Corporation** (30 B Street, Burlington, MA 01803; 617-229-2924) has unveiled *The Electric Desk*, an integrated software program for the PC*jr*. It combines four functions—word processing, spreadsheet analysis, database management, and communications. The program features windows, a macro programming language, and context-sensitive help screens. $295.

Δ **Prelude Corporation** (20380 Town Center Lane, Cupertino, CA 95014; 408-257-6033) has announced *Pro-Kit*, a multifunction expansion memory module that expands the PC*jr*'s memory by as much as 512K. It also includes an on-board quartz clock/calendar and a printer port. 64K version, $395; 128K version, $455.

Δ *PC Reset*, a hardware reset button that works when control-alt-delete does not, is available from **Security Microsystems Consultants** (16 Flagg Place, Staten Island, NY 10304; 212-667-1019). The kit can be installed with a screwdriver and a pair of pliers, and it requires no modifications to the circuit board. $89.95.

Δ **Sandra Pakin and Associates** (6007 North Sheridan Road, Chicago, IL 60660; 312-271-2848) has released *The Starter Writing Guide*, a writing-guide framework that provides basic standards for documentation writers to help them produce consistent, grammatically and mechanically correct documentation. The disk

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contains the framework in three formats: *WordStar, MultiMate*, and ASCII. $40.

Δ **AST Research** (2121 Alton Avenue, Irvine, CA 92714; 714-863-1333) has introduced the *AST-PCnet II*, a local-area network that eliminates the need for dedicated print and file servers, includes a print spooling capability, and simplifies installation. Requires 128K. $1,290. *MonoGraphPlus* is a high-resolution graphics board that adds bit-mapped graphics capabilities to the monochrome display. $545.

Δ **DSS Development** (4 Barnard Lane, Bloomfield, CT 06002; 203-243-5554) has introduced *OptionWare*, a series of integrated software packages that provide applications for *1-2-3*. Each application uses the same simple, standard menu, which reduces the user's input to five principal keystrokes. All *1-2-3* capabilities are retained. The series currently has fifty-two packages and is expected to grow to more than two hundred. $130 per application. Requires *1-2-3*.

Δ Three programs have been released by **Hayden Software** (600 Suffolk Street, Lowell, MA 01853; 800-343-1218) for writers. *PIE Writer*, long a popular word processor for the Apple, is available in a PC version that offers split-screen or alternate-screen editing of two files at once, makes full use of the function keys, and creates and works with standard DOS files, which may be larger than memory. In 128K, the program loads into memory, eliminating swapping and freeing the drive. $199.95. Δ *The Writer* is an easy-to-use, home version of *PIE Writer*. Features include form-letter output, tabbing both by word and by movable marks, justification, control page breaks, headers and footers, text transfer from file to file, and file chaining. DOS 2.0 and 2.1 versions require 96K. $49.95. Δ *The Speller* is a dictionary of more than 20,000 words for checking files created by *PIE Writer, WordStar, Volkswriter*, and *Final Word*, as well as *EasyWriter*'s ASCII files. $49.95.

Δ *File Transfer System* is a utility from **Mackensen Distributed Systems** (3323 Pearl Street, Santa Monica, CA 90405; 213-452-5520) that allows files to be transferred between the PC and mainframes running TSO, via the IRMA Decision Support Interface. $295.

Δ *PC-Handler*, from **Synetix** (10635 N.E. Thirty-Eighth Place, Kirkland, WA 98033; 206-828-4884), is a multifunction card that links up to four PCs in a shared-resource network. PCs can share, access, and transfer the same files, as well as use the same peripherals. The board features two serial ports, four parallel ports, expandable RAM memory, clock, integral software, and disk emulation. $795.

Δ **Rocky Mountain Software Systems** (Box 3283, Walnut Creek, CA 94598; 415-680-8378) offers *NewWord*, a word processor for use with all IBM personal computers. The program features merge print built in, an unerase command, microjustification, and programmable function keys. The program is keystroke-identical and command- and file-compatible with *WordStar*. Requires 96K. $249.

Δ A new version of *Word*, from **Microsoft** (10700 Northup Way, Bellevue, WA 98009; 206-828-8080), has been introduced that runs with the Hercules Graphics Card, thus allowing all the features of the program to be used for the first time in high resolution with the monochrome monitor. $375.

Δ *VCN ExecuVision* is a presentation graphics program from **Prentice-Hall** (200 Old Tappan Road, Old Tappan, NJ 07675; 201-767-5000) that enables users to generate graphics, text, and illustrations with just a few keystrokes. Techniques include automatic pie, bar, and line graphs, as well and text and image processing, sketch and paint capabilities, and motion processes. $395.

Δ **Corona Data Systems** (31324 Via Colinas, Westlake Village, CA 91361; 818-706-1505) has announced a portable, hard-disk-based IBM-compatible personal computer. The *PPCXT* incorporates a half-height, 5 1/4-inch ten-megabyte Winchester disk drive. Bundled software includes MS-DOS 2.0, GWBasic, *MultiMate*, and *PC Tutor*. $4,895.

Δ **SofTech Microsystems** (16885 West Bernardo Drive, San Diego, CA 92127; 619-451-1230) offers a bundled *USCD Pascal/p-system/Insight Window Designer* package for the PC*jr*. The latter program is a windowing toolkit that provides color windowing capabilities and enhancements for multiapplication integration, including a text-based window editor, hierarchical menus, and on-line help services in an open-application programming environment. A version for the PC and XT also is available. $399. *Insight Window Designer* separately, $99.

Δ *Forte-Call*, from **Forte Data Systems** (1500 Norman Avenue, Santa Clara, CA 95050; 408-980-1750), ties remote PCs or XTs to an organization's mainframe-based data network. A host PC in the workplace must have one of the company's 3270 emulation boards. Other PCs then access the mainframe through the host. $295.

Δ *SongWright* is a music processor from **SongWright** (928 Fillmore Street, Denver, CO 80206; 303-321-0481). It enables users to compose, save, edit, transpose, and play songs, as well as prepare printed music. Lyrics can be aligned with chord notations and notes. It features a full two-octave range, seven key signatures, multiple time signatures, and chordal harmony. Requires an IBM or Epson graphics printer. $24.95.

Δ **Data-Win** (Box 60995, Terminal Annex, Los Angeles, CA 90060; 213-250-3916) has announced *Presidential Fever*, an educational game that teaches about U.S. politics, history, geography, economics, and sociology. The game has three versions: presidential election, Republican convention, and Democratic convention. Requires 128K and DOS 2.0. $39.95.

Δ *Blood Gas Consultant*, from **Medical Software Consortium** (502 Springmont Drive, Hopkinsville, KY 42240; 502-886-0208), is a complete arterial blood gas interpretation package. It features complete acid/base and respiratory analysis of arterial blood gases, data storage for later recall, and hard-copy printouts suitable for inclusion in the patient's medical record. $595.

Δ **Stilwell Software Products** (16403 North Forty-Third Drive, Glendale, AZ 85306; 602-978-4678) has introduced *Freecalc*, a user-supported electronic spreadsheet with 100 rows and twenty-five columns. The program has been designed to give particular attention to the needs of the first-time spreadsheet user. Requires 128K; 198K for DOS 2.0. $35.

Δ **Strategic Locations Planning** (2471 Golf Links Circle, Santa Clara, CA 95050; 408-247-1956) offers *Atlas*, an interactive, menu-driven package that generates maps and displays data at the state, county, congressional district, ASI or DMA advertising region, zip code, or census-tract levels. Users can select from three hundred modifiable hatching patterns, sixteen colors, three region label sizes, and many options for legend and title placement. Requires 192K, color/graphics adapter. $225.

Δ *The Pacemaker Followup System*, from **Trinity Computing Systems** (1020 Holcombe Boulevard, Houston, TX 77030; 713-790-1894), enables hospital-based and private physicians to maintain records on pacemaker patients and supplies. The system provides for each patient a detailed record that includes data on implants, reprogramming, and follow-up activities. Hospital version, $5,500. Private practice version, $5,000.

Δ **Qualitas** (8314 Thoreau Drive, Bethesda, MD 20817; 301-469-8848) has announced *PrintMan*, a printer utility that allows the user to set printer commands directly from full-screen checklists. The user selects options from the display of printer commands without programming or looking up control codes. Requires 128K. $49 for one printer; $15 for each additional printer.

Δ **Micromedx Corporation** (187 Gardiners Avenue, Levittown, NY 11756; 516-735-8979) offers *Nutriplan*, a meal-planning and calorie-monitoring program that lets diners determine the nutritional value of meals. The program has a built-in directory of more than 400 common foods, and users can add up to 75 entries. $75.

Δ **McDermott Computer Services** (12 Manor Haven Road, Toronto, Ontario, Canada M6A 2H9; 416-789-0783) has announced *Ultimate Control*, a word processor that contains a general-purpose editor, a print formatter, a cross-reference generator, global correction, word count, and file organization. The program comes with a source code listing in CBasic and 8080 assembler, along with instructions on how to alter the code to suit specific needs. $29.95.

Δ **Functional Software** (Box 237, St. Clair Shores, MI 48080) has introduced *The Calculator*, a business and scientific calculator that performs simple calculations or computes complex formulas. It has thirty-five built-in functions, up to ten user-defined functions per configuration, and the ability to save configurations on disk. Requires 128K. $49.95.

Δ **Trio Systems** (2210 Wilshire Boulevard, Santa Monica, CA 90403; 213-394-0796) has announced *C-Index+*, a data-management tool for C programmers. The package can be linked into C applications providing variable-length data storage and data indexing functions. Also, the indexing features can be used as a standard ISAM system for keyed access to fixed-length data files. $400.

Δ *Opt-Tech Sort 2.0*, from **Opt-Tech Data Processing** (Box 2167, Humble, TX 77347; 713-454-7428) is an assembly language sort/merge program that sorts *dBase II* files and can be linked as a subroutine. The program can simultaneously sort up to ten input files of any record length or file size. Variable- and fixed-length data can be sorted on up to nine key fields. It can sort 1,000 records in ten seconds. $99.

Δ Belboz the Necromancer has vanished, and there are signs that he is in thrall to evil sorcery. That's the scenario for *Sorcerer*, one of two new titles from **Infocom** (55 Wheeler Street, Cambridge, MA 02138; 617-492-1031). This is the second in the Enchanter series of adventure in the mystic arts. $49.95. Δ Only you can save the Aquadome, the world's first undersea research station. So begins *Seastalker*, Infocom's first game designed for those as young as nine. $39.95.

Δ **Sam Wilson and Associates** (Box 37085, Houston, TX 77237; 713-785-7830) has released *Banner*, a utility that prints text in large block letters lengthwise on continuous forms using any parallel-interfaced printer. It allows the choice of six-inch- or three-inch-high characters, prints banners up to seventy-five characters long, and provides for printer port selection. Banners can be up to twenty feet long. $39.95. ▲

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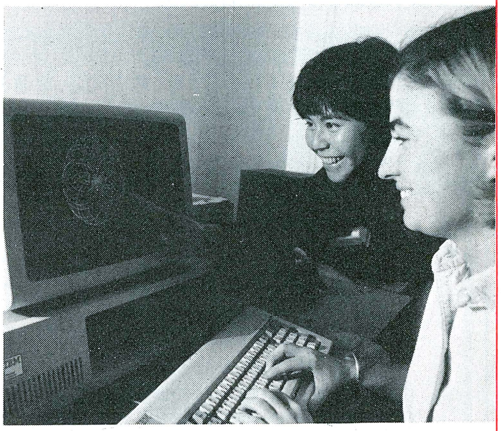

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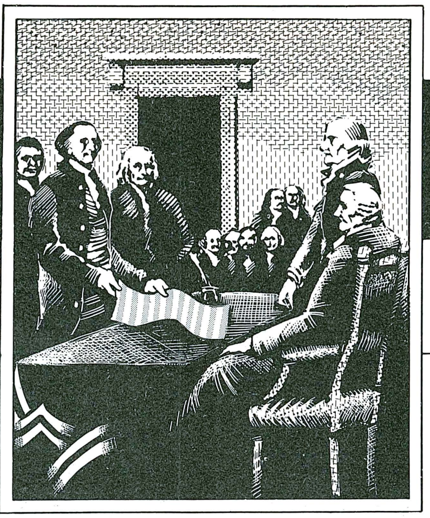

THE RIGHT TO ASSEMBLE

by Ray Duncan

Shifts and Rotates

Our subject this time is the general class of instructions known as *shifts and rotates*. All of these instructions have the property of sliding a value to the left or right through one or more bit positions. They differ from each other either in what they insert into the bit position left vacant by the shift or rotate or in how they dispose of the bit that "falls off the edge."

Compared to its eight-bit ancestors, the Intel 8088 has a rich and powerful repertoire of shift and rotate instructions. They can be used to manipulate sixteen-bit values in any of the eight data registers (AX, BX, CX, DX, SI, DI, BP, SP) or eight-bit values in any of the half registers (AH, AL, BH, BL, CH, CL, DH, DL). In addition, they can operate directly on the eight- or sixteen-bit contents of memory locations addressed via all of the 8088's addressing modes.

Overview by Groups. The *arithmetic shifts* are represented by two mnemonics: SAR (Shift Arithmetic Right) and SAL (Shift Arithmetic Left). They are dubbed "arithmetic" because they preserve the sign of numbers and can be used to perform fast signed multiplications or divisions by powers of two. As you know, when a binary value is regarded as a signed number, the most significant bit is 0 if the number is positive and 1 if the number is negative. A right arithmetic shift must preserve the value at this bit position while propagating it into the other vacated bit positions. For example, assume that AX contains the number −2, which has the two's complement representation FFFEH. After we perform the instruction

```
SAR  AX,1
```

the register will contain the value −1, or FFFFH, and the carry flag will be 0. The sign bit (bit 15) is preserved and copied into bit 14, and the rest of the bits are shifted one position to the right.

Both the left and right arithmetic shifts copy the bit that's "shifted out" into the Carry Flag. The left arithmetic shift instruction has the same machine op-code as the left logical shift, which is discussed below.

The *logical shifts* come in two flavors: SHR (Shift Right) and SHL (Shift Left). These instructions perform straightforwardly without any special treatment of the sign bit. The vacated bit position always becomes 0, and the bit that's shifted out is always copied into the Carry Flag. The logical shifts are used to perform fast multiplies and divides on *unsigned* values and are therefore very handy for address calculations.

Using our previous example again, suppose that AX contains the unsigned value 65534 (FFFEH). After the computer executes:

```
SHR  AX,1
```

AX will contain 32767 (7FFFH) and the Carry Flag will be zero.

There are two *simple rotate* instructions: ROR (Rotate Right) and ROL (Rotate Left). These perform a circular shift on the designated register or memory location; that is, the bit that's shifted out from one end is moved into the vacated position on the other. The bit that switches ends, so to speak, is also copied into the Carry Flag. The advantage of the simple rotate instruction is that it is reversible; the original value can be restored by another left or right rotate.

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Assume that register AX contains 0001H. After the 8088 executes

```
ROR AX,1
```

the AX register will contain 8000H and the Carry Flag will be set to 1.

Finally, we have the two *rotate through carry* instructions: RCR (Rotate through Carry Right) and RCL (Rotate through Carry Left). The state of the Carry Flag *before* the instruction is executed determines the value of the bit inserted into the vacated position; the value of the bit shifted out becomes the state of the Carry Flag *afterward*. As we'll soon see, these two operations are handy for the propagation of bit shifts through multiple registers or memory locations.

Imagine that register AX contains the value 0001H and the Carry Flag is 0. After we perform

```
RCR AX,1
```

register AX contains 0000H and the Carry Flag is set to 1.

Multiple Shifts and Rotates. Each of the instructions just described can be coded as either a single- or multiple-bit operation. To signify a single-bit shift or rotate, put a *1* in the part of the operand field that normally contains the source operand. For example, to rotate the contents of register DI left one position, code:

```
ROL DI,1
```

To perform a multiple-bit shift or rotate, you must first ensure that the CL register contains the number of iterations you desire, then code the shift/rotate instruction with a *CL* in the source operand field. For example, to do a logical shift left four bit positions on the contents of BX, you might write:

```
MOV CL,4
SHL BX,CL
```

The above two instructions and the following sequence

```
SHL BX,1
SHL BX,1
SHL BX,1
SHL BX,1
```

would be identical in their effect on the BX register. There are ramifications to consider, however, when choosing between these two instruction sequences. The most obvious one is that the "CL" variation of SHL overwrites the previous contents of the CL register. Less obvious effects relate to execution speed and the number of bytes occupied by the instructions.

The first combination, consisting of a MOV and a single SHL, occupies only four bytes of memory. The second, with four SHL instructions in a row, occupies eight bytes of memory. Clearly, the first version executes faster, right? Wrong! According to the Intel documentation, the MOV and SHL sequence takes twenty-eight machine cycles, while the series of four single-bit SHLs requires only eight. A rather dramatic trading of space for speed.

Shifts and Flags. In addition to their aforementioned effects on the Carry Flag, the shifts and rotates also change one or more of the Zero, Sign, or Overflow status flags. See figure 1 for a summary.

Things That Are Shiftable. As mentioned before, you can apply your newfound arsenal of shift and rotate commands to any of the general sixteen-bit registers. For example,

```
ROL AX,1
RCL DI,CL
```

You can also use these instructions on any of the eight-bit half registers:

```
SAR BH,1
SHR DH,CL
```

You can shift or rotate values directly in memory, without loading them into a register first. All of the 8088's direct or indexed addressing modes are legal. For example,

```
XYZ DW 0
     •
     •
     •
    SHL XYZ,1
```

If you are not explicitly referencing a named, typed variable, you need to tell the assembler whether you want the eight-bit or sixteen-bit variety of the instruction—or else you may not get the code you expect. For example:

```
ROR BYTE PTR [BX],1
```

would be used to "right rotate" a one-byte value whose address is in the register BX, while

```
ROR WORD PTR [BX],1
```

would be used to "right rotate" a sixteen-bit (two-byte) value. In the latter case, the address in BX points to the first, or least significant, byte.

A Few Practical Examples

Fast Multiplication. In order to fetch data out of an array, it is usually necessary to multiply an index by some power of two that relates to the number of bytes per item of data. Suppose that AX contains the index and we want to multiply it by 4 to get the true offset into the array. We could code:

```
MOV DX,4
MUL AX,DX
```

which would take a minimum of 118 cycles to execute, or we could write:

```
SHL AX,1
SHL AX,1
```

which requires only four cycles! The first version also destroys the previous contents of register DX, while the second doesn't affect any other registers. With a little additional trickery, we can use shifts to multiply by numbers other than powers of 2. The following code multiplies the contents of register AX by 10 (this is a useful gimmick for converting ASCII numeric strings to binary):

```
MOV BX,AX
SHL AX,1        ; * 2
SHL AX,1        ; * 4
ADD AX,BX       ; * 5
```

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```
SHL  AX,1        ; * 10
```

Fast Division. Bit maps are extremely useful concepts that find application in relocation of object code, sorting and searching, and logical operations on data sets. Assume that BX contains the base address of a bit map and AX contains a bit number in the range 0 through 65535. We'll first divide the bit number by 8 to find the byte offset, then use the remainder to isolate and test the specific bit:

```
MOV CX,AX
SHR  AX,1
SHR  AX,1
SHR  AX,1
ADD BX,AX
MOV AL,[BX]
AND CX,7
ROR  AL,CL
TEST AL,1
```

The Zero Flag now reflects the status (0 or 1) of the desired bit and can be used to control a conditional jump.

Multiple-Precision Multiply or Divide. The Rotate through Carry instructions can be used to multiply or divide a number of *any* byte length, and they therefore form the heart of your compiler's math library. In the following example, suppose that registers AX, BX, CX, and DX contain a sixty-four-bit integer, with the most significant sixteen bits in AX and the least significant in DX. We want to multiply the entire integer by 2, which means shifting everything left one bit. This operation can be coded:

```
SHL  DX,1
RCL  CX,1
RCL  BX,1
RCL  AX,1
```

Similarly, a signed divide by 2 could be performed on the same integer with:

```
SAR  AX,1
RCR  BX,1
RCR  CX,1
RCR  DX,1
```

or an unsigned divide by 2 with:

```
SHR  AX,1
RCR  BX,1
RCR  CX,1
RCR  DX,1
```

Fast Bit Testing. In cases where speed is of utmost importance, it is sometimes preferable to prepare for a conditional branch by using a rotate to set the Carry Flag rather than taking the more conventional approach of using the AND or TEST instructions to set the Zero Flag. For example,

```
ROR  AX,1
JB   label
```

is one cycle faster than

```
TEST AX,1
JNZ  label
```

The disadvantage of the rotate approach is that it modifies the contents of AX.

Instruction	O	S	Z	P	C
SAL	X				X
SAR	X	X	X	X	X
SHL	X				X
SHR	X				X
ROL	X				X
ROR	X				X
RCL	X				X
RCR	X				X

O = Overflow Flag
S = Sign Flag
Z = Zero Flag
P = Parity Flag
C = Carry Flag

Figure 1. Effects of shift and rotate instructions on the CPU status flags (adapted from the Intel documentation). Those of you who use the excellent book by Rector and Alexy as a reference should note that the tables on pages 4-68 through 4-70 are partially incorrect.

```
                              name    ascbin
                              page    55,132
                              title   'ASCBIN: ASCII to Binary Conversion'

                      ;
                      ; This file contains a pair of routines to
                      ; convert decimal ASCII or hexadecimal ASCII
                      ; strings into 32-bit integers.
                      ;
                      ; Ray Duncan, April 1984
                      ;
0000                  cseg    segment para public 'CODE'

                              assume  cs:cseg,ds:cseg,ss:cseg

0000                  dec_bin proc    near            ;Convert decimal ASCII string
                                                      ;terminated by zero (null) byte into
                                                      ;a 32-bit signed binary integer,
                                                      ;Conversion ends on zero byte or the
                                                      ;first unconvertable digit.
                                                      ;
                                                      ;Call with
                                                      ;DS:SI = addr of ASCII string

                                                      ;Returns
                                                      ;CY flag = 1 if illegal input string,
                                                      ;contents of other registers undefined.
                                                      ;  or
                                                      ;CY flag = 0 if legal input string, and
                                                      ;DX:CX   = signed 32-bit binary integer
                                                      ;BL      = number of digits after decimal
                                                      ;          place, or -1 if no dec. point

                                                      ;initialization...
0000  33 C9                   xor     cx,cx           ;set forming answer to zero
0002  33 D2                   xor     dx,dx
0004  BB FFFF                 mov     bx,-1           ;clear decimal place counter and
                                                      ;sign flag.
0007  8A 04                   mov     al,[si]         ;
0009  3C 2B                   cmp     al,'+'          ;is leading + sign present?
000B  75 04                   jne     dec_bin1        ;no, jump.
000D  46                      inc     si              ;yes, just skip over it.
000E  EB 08 90                jmp     dec_bin2

0011                  dec_bin1:
0011  3C 2D                   cmp     al,'-'          ;is leading - sign present?
0013  75 03                   jne     dec_bin2
0015  32 FF                   xor     bh,bh           ;yes, set sign flag and skip
0017  46                      inc     si              ;over the character.

0018                  dec_bin2:
0018  AC                      lodsb                   ;get next character from input string.
0019  0A C0                   or      al,al           ;is it null byte?
001B  74 3C                   jz      dec_bin8        ;yes,finished with string.
001D  3C 2E                   cmp     al,'.'          ;is it decimal point?
001F  74 2E                   jz      dec_bin4        ;yes,go process it.
0021  3C 39                   cmp     al,'9'          ;make sure it is legal character 0-9.
0023  77 32                   ja      dec_bin7        ;char > '9', exit with error flag.
0025  3C 30                   cmp     al,'0'
0027  72 2E                   jb      dec_bin7        ;char < '0', exit with error flag.

0029  0A DB                   or      bl,bl           ;are we past a decimal point?
002B  78 02                   js      dec_bin3        ;no,jump
002D  FE C3                   inc     bl              ;yes, count digits

002F                  dec_bin3:                       ;add another digit to forming answer.
002F  50                      push    ax              ;first save this character
0030  8B F9                   mov     di,cx           ;make copy of the current answer
0032  8B C2                   mov     ax,dx
                                                      ;multiply current answer by 10
0034  D1 E1                   shl     cx,1
```

Pop Quiz

Try to imagine a reasonable use for a shift or rotate of the SP register. The first reader sending a plausible answer (plausible, that is, in my humble judgment) will get a free box of diskettes and the pleasure of seeing his or her name immortalized in print. Send your suggestions to "What, Me Rotate?", Softalk/IBM, Box 7040, North Hollywood, CA 91605. Feedback about this column is also welcome.

Conversion Subroutines

Utility routines to convert ASCII numeric strings to sixteen-bit binary integers can be found in many books and magazine articles. In this month's program listing we provide a much more general and powerful pair of procedures that convert an ASCII decimal string into a thirty-two-bit signed integer, or an ASCII hexadecimal string into a thirty-two-bit unsigned integer. The two routines are good examples of the use of the shift and rotate instructions.

For both subroutines, the DS register should point to the segment containing the string and the SI register should contain the offset address. In these listings, the string must end with a null (0) byte, although this requirement can be easily modified. Decimal ASCII strings can have a leading + or − sign, a decimal point, and one or more characters of the set {0. . .9}. Hexadecimal ASCII strings may not have a leading sign or embedded decimal point and must be composed entirely of characters from the set {0. . .9,A. . .F}.

If the ASCII string is valid, the routines return the Carry Flag false, the upper sixteen bits of the result in register DX, and the lower sixteen bits in CX. In the case of the decimal-to-binary conversion, BL will contain −1 (0FFH), if no decimal point is encountered, or the number of digits after the decimal point if one is encountered. If the ASCII string is invalid, the Carry Flag is returned true and the contents of the other registers are undefined.

Remember, if you are a CompuServe subscriber you can download the assembly language source code for the programs printed in this column from the Programming Database of the IBM PC Special Interest Group. Enter: *GO PCS-131* at the *!* prompt, then *XA 4* to get access to the database.

Corrections

Some errors were introduced into the listing of the DUMP program (May 1984) during the typesetting process. Line 300 should read:

```
input_addr dw -1 ;relative address in file
```

Line 309 should have read:

```
db     blank
```

And line 319 should have read:

```
db     7 dup (blank)
```

▲

```
0036  D1 D2                 rcl     dx,1            ;* 2
0038  D1 E1                 shl     cx,1
003A  D1 D2                 rcl     dx,1            ;* 4
003C  03 CF                 add     cx,di
003E  13 D0                 adc     dx,ax           ;* 5
0040  D1 E1                 shl     cx,1
0042  D1 D2                 rcl     dx,1            ;* 10

0044  58                    pop     ax              ;restore new character
0045  25 000F               and     ax,0fh          ;isolate binary value 0-9
                                                    ;from the ASCII character code
0048  03 C8                 add     cx,ax           ;and add it to the forming answer.
004A  83 D2 00              adc     dx,0
004D  EB C9                 jmp     dec_bin2        ;get next character

004F                dec_bin4:                       ;decimal point detected.
004F  0A DB                 or      bl,bl           ;did we find one before?
0051  79 04                 jns     dec_bin7        ;yes, exit with error flag.
0053  32 DB                 xor     bl,bl           ;no, clear decimal point counter
0055  EB C1                 jmp     dec_bin2        ;and go to next input character.

0057                dec_bin7:                       ;illegal input string,
0057  F9                    stc                     ;return CY flag = 1
0058  C3                    ret

0059                dec_bin8:                       ;legal input string, return CY flag = 0
                                                    ;DX:CX = signed binary integer,
                                                    ;BL = digits after decimal pt.
0059  0A FF                 or      bh,bh           ;did string start with - sign?
005B  75 0A                 jnz     dec_bin9        ;no,jump
005D  F7 D1                 not     cx              ;yes, take 2's complement of answer.
005F  F7 D2                 not     dx              ;by inverting it and adding 1.
0061  83 C1 01              add     cx,1
0064  83 D2 00              adc     dx,0

0067                dec_bin9:                       ;string successfully converted,
0067  F8                    clc                     ;signal with CY flag = 0
0068  C3                    ret

0069                dec_bin endp


0069                hex_bin proc    near            ;Convert hexadecimal ASCII string
                                                    ;terminated by zero (null) byte into
                                                    ;a 32-bit binary integer.
                                                    ;Conversion ends on zero byte or the
                                                    ;first unconvertable digit.
                                                    ;
                                                    ;Call with
                                                    ;DS:SI = addr of hex ASCII string
                                                    ;Returns
                                                    ;CY flag = 1 input string illegal
                                                    ;  or
                                                    ;CY flag = 0 input string legal, and
                                                    ;DX:CX = signed 32-bit integer.

                                                    ;initialization...
0069  33 C9                 xor     cx,cx           ;set forming answer to zero
006B  33 D2                 xor     dx,dx

006D                hex_bin1:
006D  AC                    lodsb                   ;get next character from input string.
006E  0A C0                 or      al,al           ;is it null byte?
0070  74 2D                 jz      hex_bin8        ;yes,finished with string.
0072  3C 30                 cmp     al,'0'          ;no, make sure char. is legal.
0074  72 27                 jb      hex_bin7        ;char < '0', exit with error flag.
0076  3C 39                 cmp     al,'9'
0078  76 0C                 jbe     hex_bin3        ;char < '9', proceed
                                                    ;if char > '9',
007A                hex_bin2:                       ;check for char. 'A'-'F' or 'a' - 'f'.
007A  0C 20                 or      al,20h          ;first fold character to lower case.
007C  3C 66                 cmp     al,'f'
007E  77 1D                 ja      hex_bin7        ;char > 'F' or 'f', exit with error flag.
0080  3C 61                 cmp     al,'a'
0082  72 19                 jb      hex_bin7        ;char < 'A' or 'a', exit with error flag.
0084  04 09                 add     al,9            ;add fudge factor so we'll get
                                                    ;correct binary value later.

0086                hex_bin3:                       ;add another digit to forming answer.
0086  D1 E1                 shl     cx,1            ;first shift current answer left 4 bits.
0088  D1 D2                 rcl     dx,1
008A  D1 E1                 shl     cx,1
008C  D1 D2                 rcl     dx,1
008E  D1 E1                 shl     cx,1
0090  D1 D2                 rcl     dx,1
0092  D1 E1                 shl     cx,1
0094  D1 D2                 rcl     dx,1
0096  25 000F               and     ax,0fh          ;isolate binary value 0-A
                                                    ;from the ASCII character code
0099  0B C8                 or      cx,ax           ;and add it to the forming answer.
009B  EB D0                 jmp     hex_bin1        ;get next character

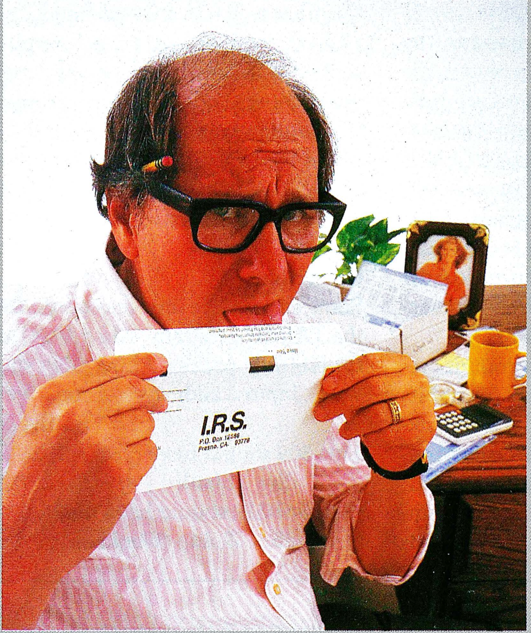
009D                hex_bin7:                       ;illegal input string,
009D  F9                    stc                     ;return CY flag = 1
009E  C3                    ret

009F                hex_bin8:                       ;legal input string, return
009F  F8                    clc                     ;DX:CX = 32-bit unsigned integer,
00A0  C3                    ret                     ;signal success by CY flag = 0

00A1                hex_bin endp

00A1                cseg    ends

                            end
```



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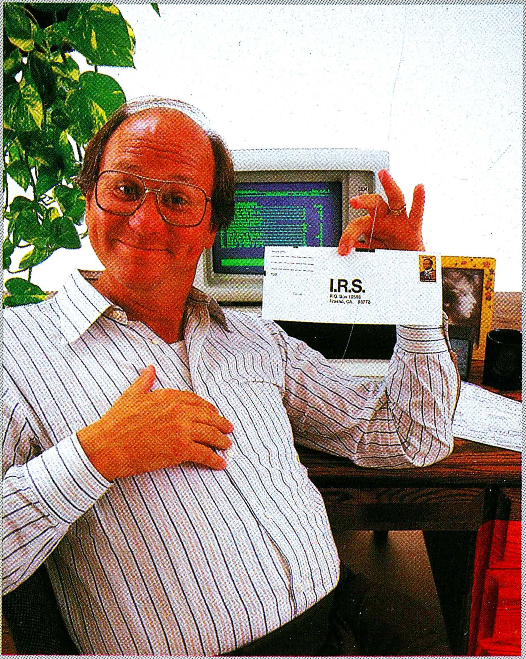

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SOFTALK PRESENTS THE BESTSELLERS

The pen may or may not be mightier than the sword, but the spreadsheet is certainly mightier than the word.

Folks, it's time once again to marvel at the absolute domination of *1-2-3* in the IBM software market. Now's as good a time as any to reemphasize the strength of the product, because the word processing genre can provide us with a standard for comparison.

First a word about word processing. Almost everyone does it. In April, four of the top ten programs and five of the top fourteen were word processors. It certainly is not a market for the faint of heart.

You've got big players: MicroPro, with a recently raised $35 million war chest; Software Publishing, with its gang of four bestselling software products; and Microsoft, with its tight relationship with IBM.

You've got new players: MultiMate International comes to the market from nowhere with a product that looks like a Wang dedicated word processor and sells like sarsaparilla at a Prohibition conclave.

You've got little players: Satellite Software competes with the big guns from a Utah base that's as distant from the centers of silicon culture as the XT is from the Junior.

As it washed out in April, the winner by a nose in this hot competition was *MultiMate*, seventh in the Top Thirty. *PFS:Write* was eighth, *WordStar* ninth, *WordPerfect* tenth, and *Word* fourteenth.

So what does all this have to do with *1-2-3*?

Together, these five packages, from some of the biggest purveyors of microcomputer software in America, almost sold as much as *1-2-3*. There was a couple-of-thousand-unit difference between the aggregate of the five word processors and the sales of Mitch Kapor's breadwinner.

1-2-3 is so hot it makes a microwave oven seem like a Boy Scout campfire. *1-2-3* is so strong it could make a monkey out of King Kong. *1-2-3* generates enough cash to make Croesus weep with envy.

Competitors can only shudder at the thought that *1-2-3* is not Kapor at his best. He's got *Symphony* coming down the road. What great fun if you've got a spreadsheet or integrated software package of your own. It seems more futile to compete with *1-2-3* than it would be to try to drain the Gulf of Mexico with a teaspoon.

Even as a product starts taking on the aura of invincibility, however, new evidence comes to light that undermines that conviction. This month the example is Ashton-Tate and *dBase II*.

For months, *dBase II* has sold so well that no other database product has been able to achieve any significant movement in the IBM market. It's generally been true that *dBase II* has been to databases what *1-2-3* has been to spreadsheets. The major difference has been the wider market for spreadsheet products.

Ashton-Tate scored even better in April than usual. *dBase* pushed ahead of *Microsoft Flight Simulator* into second place on the Top Thirty. *Friday!* also moved onto the bottom rung of the list. *Friday!* is a simplified version of *dBase II* that flared briefly on introduction, then disappeared from sight. Now its prospects are healthy and it's gaining wider acceptance.

So what happens?

Along comes *R:Base 4000* from Microrim. Just when it was looking as foolish to tackle *dBase II* as it was to challenge *1-2-3*, *R:Base* climbed into twenty-ninth place. It isn't exactly a neck-and-neck race yet—*dBase II* is selling eight times as well as *R:Base 4000*—but the very fact that *R:Base* made a dent can give hope to the numerous software publishers intent on assaulting *1-2-3*'s position.

The biggest surprise showing in April came from *Sideways*, a print

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utility that provides the capability to dump data in the manner its name implies. *Sideways* has been around for a while without making many waves, but it jumped into sixteenth, the best showing of any product new to the list.

Other software that made the list for the first time includes *Harvard Project Manager,* in twenty-seventh, and *Delta Drawing,* in twenty-eighth. *PFS:Graph* rejoined the Top Thirty.

The showing of *Barron's SAT* is particularly strong, as it overhauled *Computer SAT* from Harcourt Brace Jovanovich, a program that had already established itself in the market.

The presence of such titles as *Barron's SAT* and *Delta Drawing* speak for the impact of PC*jr* on the market.

Some things stay relatively static. *PFS:File,* April's fifth-ranked program, has no competition in sight. *Crosstalk* continues to clobber *Asynchronous Communications Support 2.0* in the communications market. And *Home Accountant Plus* continues to ward off *Dollars and Sense* as the personal finance choice.

April turned out to be a mixed month for Software Arts, author of *VisiCalc. VisiCalc: Advanced Version* plummeted in the face of *1-2-3's* strong showing, but *TK!Solver* tied for thirty-second, its best showing in some months. ▲

TOP THIRTY

This Month	Last Month	Index	
1	1	249.63	**1-2-3**, Mitch Kapor and Jonathan Sachs; Lotus Development
2	3	97.33	**dBase II**, Wayne Ratliff; Ashton-Tate
3	2	91.37	**Microsoft Flight Simulator**, Bruce Artwick; Microsoft
4	4	70.19	**PFS:File**, John Page and D.D. Roberts; Software Publishing Corporation
	10	70.19	**Copy II Plus**; Central Point Software
6	12	60.91	**Crosstalk**; Microstuf
7	26	52.31	**MultiMate**; MultiMate International
8	5	48.33	**PFS:Write**, Sam Edwards, Brad Crain, and Ed Mitchell; Software Publishing Corporation
9	6	46.35	**WordStar**; MicroPro
10	24	41.71	**WordPerfect**, Alan Ashton and Bruce Bastian; Satellite Software
11	8	37.74	**PFS:Report**, John Page; Software Publishing Corporation
12	9	35.75	**Multiplan**; Microsoft
13	18	35.09	**MasterType**, Bruce Zweig; Scarborough Systems
14	29	33.10	**Word**; Microsoft
15	29	31.78	**Norton Utilities**, Peter Norton; Peter Norton Inc.
16	—	29.79	**Sideways**; Funk Software
17	13	27.14	**Home Accountant Plus**, Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Arrays/Continental Software
18	11	26.48	**Zork I**; Infocom
19	—	23.83	**PFS:Graph**, Bessie Chin and Stephen Hill; Software Publishing Corporation
20	7	19.86	**Typing Tutor**, Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)
21	16	17.87	**Basic Compiler**, Microsoft; IBM
	22	17.87	**Dollars and Sense**, Frank E. Mullin; Monogram
23	22	16.55	**Macro Assembler**, Microsoft; IBM
24	—	15.89	**Harvard Project Manager**; Harvard Software
25	15	15.22	**Asynchronous Communications Support 2.0**; IBM
	—	15.22	**Sorceror**; Infocom
27	—	14.56	**Barron's SAT**; Barron's
28	—	13.90	**Delta Drawing**, Computer Access Corporation; Spinnaker Software
29	—	12.58	**R:Base 4000**; Microrim
30	—	11.25	**Friday!**; Ashton-Tate
	20	11.25	**Early Games for Young Children**, John Paulson; Counterpoint Software

IBM-franchised retail stores representing approximately 4.89 percent of all sales of IBM and IBM-related Personal Computer products volunteered to participate in the poll.

Respondents were contacted early in May to ascertain their sales for the month of April.

The only criterion for inclusion on the list was the number of units sold; such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in May represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

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